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LAND AND FRESHWATER

MOLLUSCA OF INDIA,

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KASHMIR, NEPAL, BURMAH, PEGU, TENASSERIM,
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ISLANDS OF THE INDIAN OCEAN.

SUPPLEMENTARY TO MESSRS. THEOBALD AND HANLEY'S

CONCHOLOGIA INDICA.

BY

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F.R.S., F.G.S., F.Z.S., &c.,
LATE DEPUTY SUPERINTENDENT TOPOGRAPHICAL SURVEY OF INDIA, IN CHARGE OF
THE KHASI, GARO, AND NAGA-HILLS SURVEY PARTY.

VOLUME I.

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INTRODUCTION.

In issuing the First Part of 'Land and Freshwater Mollusca of India,' the undersigned is attempting to carry out what the editors of the 'Conchologia Indica' express a hope of at the end of their Preface. They say that work was never intended to be exhaustive, but to assemble in one book species which were dispersed in scores of other volumes. I can hope to do but little more.

But the 'Conchologia Indica' was brought to an end before the editors had exhausted all the known species from India; and since then a very large number of new forms have been discovered in that vast country, with its varied climate and conditions, and where every year new areas are visited by the naturalist and collector. Although I have published many new species brought together by myself, there are still many left in my collection; while H. F. and W. T. Blanford, Col. Beddome, W. Theobald, Geoffrey Nevill, Col. Mainwaring, Dr. Hungerford, Dr. Townshend, Professor J. Bayley Balfour in Socotra, Messrs. M. T. Ogle, A. Chennell, W. Robert, and H. Godwin-Austen have added many an additional species to the list, so that there is no lack of material. With the aid of the above gentlemen and others I hope to make this supplementary work as valuable as its predecessor.

Mr. W. T. Blanford, in a late paper in the 'Journal of

the Asiatic Society of Bengal'*, summing up what has been done in Indian conchology, says:—"The same decade (1870 to 1880) has seen the completion of a series of illustrations, many of them well executed, of Indian land and freshwater shells, the 'Conchologia India' of Hanley and Theobald. The work is mainly due to Mr. Hanley, upon whom the whole of the editorial labour has fallen, Mr. Theobald having been absent in India during the publication. Whilst it is impossible to avoid regretting that more complete illustrations of most of the species have not been given, and that some additional details have not been furnished in the accompanying letterpress, it is unquestionable that the plates are a valuable contribution to the knowledge of Indian Mollusca. . . . . . Two other rather important works on Indian land and freshwater shells have been issued since the completion of the 'Conchologia Indica.' One of these is Mr. Theobald's 'Catalogue of the Land and Freshwater Shells of British India,' the other Mr. G. Nevill's 'Hand-list of the Mollusca in the Indian Museum, Calcutta,' Part I. . . . . . This work is especially important for the large number of exact localities given; . . . . . and in many points the classification adopted for the Helicidæ of India is a considerable improvement on any thing that had previously been published. At the same time there is, I believe, very much more to be done before these puzzling shells are properly arranged."

Every illustrated work of this kind is a step in advance in the study of Natural History; and I propose, besides the figuring of new species, to take up those minute forms that have not been sufficiently enlarged and well drawn in the 'Conchologia Indica,' such as the small forms of Helices, and those among the Cyclophoridæ and Helicinidæ—*Alycæus, Diplommatina, Acmella, Georissa,* &c.

* "Contributions to Indian Malacology.—No. XII." (Dec. 1, 1880).

Drawings of the animals will also be added, with the anatomy whenever it can be obtained, showing the odontophore &c., by the help of which I trust we shall be able to arrive at some better-defined system of classification to what we have now, based solely on shell-characters. We shall then be better able to understand the relationship between our Indian genera and those of the neighbouring regions which are being worked out on one side by Professor von Martens and O. Semper, and on the African &c. by Professor A. Morelet, J. R. Bourguignat, and many other foreign conchologists.

Not the least important part of the work will be attention to the record of accurate distribution of species; and I shall always give the exact locality and districts of India, with elevation &c.

I shall not limit myself to political boundaries, or what is termed British India; such boundaries are being constantly altered or overstepped by the naturalist; the progress of a friendly mission or the entry of a punitive force into some adjacent independent country brings a fresh crop of objects of natural history. I therefore take as a northern limit the watershed of all the rivers that flow into the Indian Ocean through the countries named on the titlepage; thus the Indus will include the whole of Afghanistan and Kafiristan, Swat, Gilgit, Baltistan or Little Tibet, Ladak, Rudok up to the Manasarowa Lake. The Brahmaputra will include that vast unknown country northwards and eastwards of the junction of the Dihong and Dibong rivers, any part of which we may see, and I hope to see, explored within the next four or five years, and the same of the Irrawaddy and Salween, while the southern extension of the Mulé-it range, in Tenasserim, down to the Malay Peninsula, gives a very well-defined boundary in that direction. I have included South Arabia as far as the vicinity of Aden, because on that side we have a mingling of East-

African and Indian forms. Unless we take the wide area indicated above, we shall never be able thoroughly to elucidate the distribution of the different genera and species, and how they overlap the confines of the Oriental, Palæarctic, African, and Malayan Regions.

A great want in India at present is that of good text-books on the Natural History of the country for the use of European and native students. The Vertebrata have received attention, and many able works have been written on some classes: all these, however, are not brought up to our present knowledge. But nothing has ever been attempted among the vast array of the Invertebrata; and I only hope that the small additional labour I bestow on one group, the Mollusca, will hereafter lead up to such Handbooks being published; but I fear nothing can be expected without some Government assistance, such as was once afforded to Dr. T. C. Jerdon to bring out the 'Birds of India.'

H. H. GODWIN-AUSTEN.

ERRATA IN PARTS I. & II.

Page 11, line 12 from top, for *Lithocystis* read *Liocystis*.
,, 26, ,, 24 from top, for *tubiniformis* read *turbiniformis*.
,, 34, ,, 5 from bottom, *for* Thamandaiva *read* Thamandava.
,, 40, ,, 22 from top, *for* Nolamullies *read* Kolamullies.
,, 59, ,, 20 from bottom, erase (*Jarava*).
,, 59, ,, 17 from bottom for *increscens* read *virescens*.

ERRATA.

PART III.—January 1883.

Page 80, line 17 from bottom, *for* plate xi. *read* plate ii.
,, 94, Plate XIX. fig. 1, *for* Bhangulpur *read* Bhaugulpur.
,, 94, ,, XIX. fig. 4, after *perplana*, Nevill, *insert* MS.
,, 94, ,, XX. fig. 2, for *Macrochlamys* read *Kaliella*.

PART IV. (Plates).—September 1883.

Plate XLII., read AFRICARION PALLENS?, Morelet (received as *Vitrina rüppelliana*, Pfr., Abyssinia, from Mr. Damon).

LAND AND FRESHWATER MOLLUSCA

OF

INDIA.

Family ZONITIDÆ *.

Subgenus Kaliella.

(Plates I. & II.)

This genus was formed by Mr. W. T. Blanford in February 1863, and published in the 'Annals and Magazine of Natural History' †; he included in it:—

1. *fastigiata*, Hutton. Western Himalayas, Nilgiri Hills.
2. *barrakporensis*, Pfr. Base of Sikkim Himalayas, and Kalryenmullay Hills, near Salem, in S. India (*Foote*).
3. *aspirans*, W. & H. Blanf. Nilgiri Hills.

Now the first type-shell, *fastigiata* from the Nilgiri Hills, as I show further on, is not Hutton's species from the N.W. Himalaya, which Mr. Blanford I do not think then had had an opportunity of comparing it with; so we must fall back on *barrakporensis*, and take

* The genera and subgenera will be treated of in no particular order at present, but as data concerning them can be put together and the drawings completed. The classification can hereafter be attempted; we shall then be better able to judge what weight, generic or subgeneric, to give to the many genera now recorded from the Indian Region.

† "On Indian Species of Land-Shells belonging to the Genera *Helix*, Linn., and *Nanina*, Gray."

it as the typical form of the genus. Fortunately, it is immaterial in this instance which species is taken, for it is quite clear what group of shells *Kaliella* is intended to include, and either three species might be taken for the type. I wish one could say this of some other genera—*Nanina*, Gray, for instance. The first two species of Mr. Blanford's genus were included by Albers ('Die Heliceen,' 1860, edit. Von Martens) in his genus *Trochomorpha*; but, as he has taken *trochiformis*, Fér., from the Fiji Islands, as the type, it must be exclusively used for species from that part of the world, which are not at all likely to be related to these Indian forms: moreover, when *Trochomorpha* was made to hold such very dissimilar shells as *fastigiata*, *anceps*, and *serrula*, the sooner it was restricted the better; and *attegia*, *infula*, *cacuminifera*, and *arx* were soon removed from it by Stoliczka, the first becoming the type of his genus *Conulema* (J. A. S. B. 1871, p. 236), the second the type of Adams's genus *Sitala*, which has priority. Drawings of species of this genus I hope to give at an early date.

KALIELLA BARRAKPORENSIS, Pfr. (Plate I. fig. 1.)

H. barrakporensis, Pfr. P. Z. S. Dec. 1852, p. 156; Chemn. ed. ii. *Helix*, n. 969, t. 147. figs. 20, 22; Conch. Ind. pl. lxxxvii. f. 7; Theob. Suppl. Cat. C. I. p. 20; Benson, Ann. & Mag. N. H. April 1859, p. 272; Nevill, Hand-l. 1878, p. 41. no. 191.

Original description:—"H. *testa subperforata, elevato-trochiformi, tenui, striatula, nitida, pellucida, fusco-cornea; spira conica, acutiuscula; sutura profunda; anfr.* 6, *convexis, lente accrescentibus, ultimo carinato, non descendente, basi convexiusculo; apertura vix obliqua, depressa, subangulato-lunari; perist. simplici, tenui, recto, margine columellari brevi, ad perforationem punctiformem reflexiusculo.*

"Diam. $3\frac{1}{2}$, alt. $3\frac{1}{2}$ mill.

"*Hab.* ad Barrakpore, Indiæ (*Bacon*)."

The animal is of a pale colour, with a distinct gland at the extremity of the foot, with a well-defined lobe above it. Stoliczka, in his description attached to a drawing left to us by him, says—"I have not seen any mantle-lobes; pinkish grey, tentacles and head darker." In J. A. S. B. 1871, p. 237, the same author writes—"The anatomy of *H. barrakporensis* closely resembles that of *Conulema*, but the dentition is different, that species having fewer teeth in a transverse row and a great number of the median ones enlarged, all being squarish, not pectiniform."

Locality ——? Ex Museum Cuming, now in collection of W. T. Blanford, marked an authentic specimen.

Shell pyramidal, subperforate; sculpture very fine close-set ribbing, with fine spiral lines on base; colour umber-brown; spire high, conic, sides slightly convex; suture moderately deep; whorls $5\frac{1}{2}$, convex, keeled on last, convex below; aperture suboblique, quadrately lunate; peristome thin, columellar margin subvertical and slightly reflected near the perforation.

*Size: major diam. 0·12 inch, alt. axis 0·1 inch.
„ 3·0 mm., „ 2·6 mm.

KALIELLA BARRAKPORENSIS, Pfr. (Plate I. fig. 2.)

Locality. Barisal, forty miles above, near the river Megna, Lower Bengal (*G.-A.*).

Shell pyramidal, somewhat depressed, base flat; sculpture rather close, fine costulation, each rib distinct, the spiral sculpture on the base like that of Mussoorie specimens (Plate I. fig. 3 *b*); colour horny brown; spire moderately high, broadly conic, sides very slightly convex; suture shallow; whorls 5, sides flatly convex; aperture quadrate; peristome thin, columellar margin subvertical.

Size: major diam. 0·13 inch, alt. axis 0·09 inch.
„ 3·3 mm., „ 2·3 mm.

In a paper entitled "Notes on the Land and Freshwater Shells of Kashmir &c." (J. A. S. B. 1878, p. 142), Mr. W. Theobald remarks that the specific name of this shell is badly chosen, this being a hill-species (not found on the plains, unless transported on plants). I found it very abundant in the above locality in the bamboo-clumps.

KALIELLA BARRAKPORENSIS, Pfr., =*sivalensis*, Hutton, var. (Plate I. figs. 3, 3*a*, 3*b*, and Plate II. fig. 1.)

Locality. Mussoorie, N.W. Himalaya, about 7000 feet (*G.-A.*).

Shell scarcely perforate, conoid, base flat; sculpture distinct, fine transverse ribbing, close set, touching, the spiral striation on the base regular and wide apart, 4 to 5 lines =·005 inch (Plate I. fig. 3 *b*); colour pale brown; spire high, pyramidal, sides convex: suture shallow; whorls 7, flat; aperture semilunar; peristome thin, reflected on columellar margin, which is perpendicular.

Size: major diam. 0·14 inch, alt. axis 0·10 inch.
„ 3·6 mm. „ 2·5 mm.

Benson, in "Descriptions of new Helicidæ contained in the Darjiling Collections of Messrs. W. T. and H. F. Blanford" (A. & M. N. H., Apr. 1859), writes:—"Two bleached and broken specimens of a small shell allied to *H. fastigiata*, Hutton, from the Western Himalaya, were found by Mr. W. T. Blanford at Pankabari and in the Rungun valley, at elevations of 1000 and 4000 feet. They cannot be distinguished from Pfeiffer's *H. barrakporensis*, of which specimens were sent to me by the late Dr. J. F. Bacon from Titalya, on the border of the Sikkim Terai, before the shell was seen by Dr. Pfeiffer; others were more recently taken by Capt. Hutton in the Dhoon valley, below Landour, and were transmitted to me by him under the MS. name of *sivalensis*, H. . . . . . The occurrence of

* In all descriptions the most reliable measurement is that of the major diameter; not so that of the height, for it is often doubtful *how* it has been taken. In this and the following descriptions the height of the shell is taken from the lowest portion of the body-whorl at the columnar margin to the apex; this I have found much easier to take than the vertical distance from the lowest edge of the aperture to the apex. It is simple enough with the ordinary measuring instruments when dealing with solid strong shells, but very dangerous with small fragile forms.

H. barrakporensis near Calcutta is more than doubtful. There is a country-house called 'Titalya,' near Barrackpore, which may have given rise to an error in the statement of the locality of the species."

It will be seen, however, below that both Nevill and Stoliczka have taken it in or near Calcutta.

Mr. Theobald (*l. c.* p. 142) records a single specimen of this species from Kashmir, 6 mm. in height. This must be either an error in measurement or it is another species, for I have never seen among hundreds of specimens any approaching this size.

Nevill gives (*l. c.* p. 41) the following localities:—1. Parasnath (*Stol*); 2. Pegu (*Stol*); 3. Prome (*W. T. B.*); 4. Thyat Myo (*Dr. Hungerford*); 5. Teria Ghat (*G.-A.*); 6. Khandala (*Stol*); 7. Calcutta (*Nevill & Stol*). It would be interesting to see those from No. 6; those from Burmah are very possibly *K. vulcani*, described further on.

Kaliella cherraensis, n. sp. (Plate I. figs. 5, 5*a*.)

Locality. Cherra Poonjee, Khasi Hills (*G.-A.*).

Shell elongately pyramidal, scarcely perforate; sculpture very fine, regular transverse ribbing, with very fine, regular, close-set spiral ribbing on the base, 12 lines =·005 inch (fig. 5 *a*); colour dull brown; spire high, sides convex; suture shallow; whorls 6, sides flatly convex, a distinct sulcation on the keel of the last; aperture semilunate; peristome thin.

Size: major diam. 0·10 inch, alt. axis 0·09 inch.
,, 2·5 mm., ,, 2·3 mm.

Garo Hills, one specimen. Very smooth, but under lens has microscopic transverse ribbing.

The largest are from Teria Ghat. Height of spire equal to diameter of base; major diameter 3·0 mm.; colour ochraceous; whorls 7; ribbing very distinct (Plate I. fig. 7 and Plate II. fig. 2).

I have three specimens, from the Dikrang valley, Dafla Hills, from the North Cachar Hills, and Laisen in the Naga Hills.

Kaliella cherraensis, n. var. (Plate I. fig. 6.)

Locality. Forty miles above Barisal, on the river Megna, Lower Bengal (*G.-A.*).

Sculpture very fine, regular, rather distant costulation, with very fine, close-set spiral striation on base, while in many specimens quite smooth; colour pale ochraceous brown; spire, *vide* description of the Khasi shell.

Size: major diam. 0·15 inch, alt. axis 0·11 inch.
,, 2·7 mm., ,, 2·8 mm.

This shell is almost identical with the Khasi-Hill species, being, perhaps, rather more convex on the side of the spire, a character which distinguishes all the forms of *Kaliella* from those hills from the much more flatter-sided *barrakporensis* of the N.W. Himalaya &c. The waters of the Barak in Sylhet drain into the Megna, and this species must be constantly washed down by them.

KALIELLA KHASIACA, n. sp. (Plate I. fig. 8.)

Locality. North Khasi, numerous (*G.-A.*).

Shell imperforate, elongately conical, rather tumid; sculpture microscopic ribbing, quite smooth under ordinary lens; colour glassy white; spire conic, sides convex; suture impressed; whorls 8, sides convex; aperture almost semicircular; peristome thin, columellar margin perpendicular, rounded below.

Size: major diam. 0·09 inch, alt. axis 0·15 inch.
,, 2·3 mm., ,, 2·7 mm.

KALIELLA MUNIPURENSIS, n. sp. (Plate I. fig. 9, and Plate II. fig. 3.)

Locality. Munipur Hills, N.E. frontier (*G.-A.*).

Shell elongately conical, base flat; sculpture fine transverse continuous ribs, very fine and close, concentric on the basal side; colour dull ochraceous; spire as high as breadth at base, conic, sides rounded, apex blunt; suture impressed; whorls 6½, slightly convex; aperture semicircular; peristome thin, columellar margin slightly curved.

Size: major diam. 3·0 mm., alt. axis 3·0 mm.

This shell differs from the Cherra and Khasi species in the whorls being more convex, more tumid below, and the columellar margin not so oblique. It is nearest in shape to *K. aspirans* of Southern India.

KALIELLA MUNIPURENSIS, var. (Plate I. fig. 10.)

Locality. Phúnggam, Lahúpa Naga Hills, 5000 feet (*G.-A.*).

Shell elongately pyramidal, keeled, but not sharply; sculpture fine transverse ribbing on whorls, fine radiating on base; colour bleached; spire high, sides convex; suture shallow; whorls 5½, sides flatly convex; aperture semiovate; peristome thin, columellar margin strong, perpendicular.

Size: major diam. 0·09 inch, alt. axis 0·09 inch.
,, 2·3 mm., ,, 2·3 mm.

KALIELLA SIGURENSIS, n. sp. (Plate I. fig. 11.)

Locality. Nilgherri Hills, Seegoor Ghat and Neddiwuttom Passes (*W. T. Blanford*).

Shell subperforate, conical, rather flat on base; sculpture rather fine, irregular-sized, transverse ribbing, especially well developed on base, with no spiral ribbing there; colour, umber-brown epidermis; spire conic, sides rounded; whorls 7, sides rounded; aperture lunate; peristome well rounded below, columellar margin oblique.

Size: major diam. 0·13 inch, alt. axis 0·12 inch.
,, 3·25 mm., ,, 3·0 mm.

Animal unknown.

This is the shell referred to by Messrs. W. T. and H. F. Blanford, after the description of *H. aspirans.* in J. A. S. B. 1861, p. 356, as closely resembling *H. fastigiata*, Hutton, from the above localities. In Mr. W. T. Blanford's collection I find he must have

afterwards altered his opinion regarding it, for the label (*fastigiata*) is covered with another (*barrakporensis*); but, although close, it is certainly not that species; and in the same paper (Contributions to Indian Malacology, No. II. p. 358) *H. barrakporensis* is referred to, and a figure is given on plate ii. fig. 5 of a specimen received from Mr. R. Bruce Foote, who found it on the Kalryenmullay group of hills near Salem. I have given a copy of this figure (Plate I. fig. 4), and which appears to be this species. But the shell is not in Mr. Blanford's collection, which he has, during his absence in India, so kindly left with me to refer to and take care of. *H. fastigiata*, Hutton, of the N.W. Himalaya, does not occur in South India; and Mr. Foote's specimen of *barrakporensis* may present, on a closer examination, some slight difference from the type form. The drawing shows it to have very flat sides to the spire, with a very acuminate apex.

KALIELLA ASPIRANS, W. T. & H. F. Blf. (Plate I. fig. 12, from specimen in coll. W. T. Blanford.)

Locality. Nilgherri Hills, Madras (*W. T. B.*).

Described in the J. A. S. B. 1861, p. 355, pl. i. fig. 12, very roughly drawn.

Type from near Pykara, rare.

Conch. Indica, pl. xvi. fig. 4 is not in the least like; it gives the idea of a thickened peristome.

Th. Cat. Conch. Ind. p. 20.

Nev. Hand-list (1878), p. 41. no. 197.

Original description:—"*Testa vix perforata, elevata, pyramidalis, vix striata, tenuis, cornea. Spira turrita, apice obtusa, sutura parum profunda. Anfr. 7, convexiusculi, lente crescentes, ultimus non descendens, basi convexus, carina obtusa, prope aperturam evanescente, circumdatus. Apertura subverticalis, transverse lunata, semicircularis; peristoma tenue, rectum, marginibus distantibus, columellari breviter reflexiusculo.*

"Major diam. 2·0 mm., alt. axis 3·0 mm.
,, 0·08 inch, ,, 0·12 inch."

KALIELLA VULCANI, n. sp. (Plate I. fig. 13.)

Locality. Puppá-doung Hill, Burmah (*W. T. Blanford*).

Shell ovately conical, rather tumid; sculpture transverse, moderately close ribbing, on base radiating from umbilicus; colour (bleached) apparently of usual horny colour; spire conic, moderately high, sides convex, apex well rounded; suture shallow; whorls 6, sides convex; aperture widely lunate, slight angulation below; peristome thin, slightly reflected; columellar margin straight, subvertical.

Size: major diam. 0·12 inch, alt. axis 0·09 inch.
,, 3·0 mm., ,, 2·3 mm.

Puppá-doung is an extinct volcano in Upper Burmah below Mandalay, and some 25 miles from Pagan, on the left bank of the

Irrawaddy. The specimen described was given me by Mr. W. T. Blanford, who collected so many fine shells in that country. It is an interesting species, in its convex sides approaching the N.E. frontier forms, but at same time not like any of them in the rounded form of the apex and large aperture.

EXPLANATION OF PLATE I.

(All figs. enlarged seven times.)

Fig. 1. *Kaliella barrakporensis*, Pfr., typical. Locality?
2. —— ——. Near Barisal, Lower Bengal.
3, 3*a*. —— ——, =*sivalensis*, Hutton. Mussoorie, N.W. Himalaya.
3*b*. —— ——: sculpture on base, × 50. 4 to 5 lines=0·005 inch.
4. ——, close to *barrakporensis*; copy of figure in J. A. S. B. Salem, Madras.
5. —— *cherraensis*, G.-A. Cherra Poonjee, Khasi Hills.
5*a*. —— ——: sculpture on base, × 50. 12 lines=0·005 inch.
6. —— ——, var. Near Barisal, Lower Bengal.
7. —— ——. Fine specimen, Teria Ghat, Khasi Hills.
8. —— *khasiaca*, G.-A. Khasi Hills, northern slopes.
9. —— *munipurensis*, G.-A. Munipur Hills.
9*a*. —— ——: sculpture, × 50.
10. —— ——, var. Phúnggam, Lahúpa Naga Hills.
11. —— *sigurensis*, G.-A. Seegoor Ghat and Neddiwuttom Passes, Nilgherri Hills.
12. —— *aspirans*, W. T. & H. F. Blf. Nilgherri Hills.
13. —— *vulcani*, G.-A. Puppá-doung Hill, Burmah.

KALIELLA JAINTIACA, n. sp. (Plate II. fig. 4.)

Locality. Marangsip Peak, South Jaintia Hills, 5350 feet.

Shell subglobosely conoid, keeled, well rounded below; sculpture very close-set fine transverse costulation, concentric on base; colour pale olivaceous umber-brown; spire conic, flatly convex; suture impressed; whorls $5\frac{1}{4}$, sides convex; aperture ovately lunate, subvertical; peristome thin, very slightly reflected, columellar margin subvertical.

Size: major diam. 0·13 inch, alt. axis 0·09 inch.
„ 3·3 mm., „ 2·3 mm.

Three specimens are from Marangsip Peak and two from Sherfaisip Peak, 5600 feet.

This species is very near *barrakporensis*, but is more convex on side of the spire and more tumid below, with much wider and more open aperture.

KALIELLA COSTULATA, n. sp. (Plate II. fig. 5.)

204 of Nevill's Hand-list, p. 42 (not named).

Locality. Tanir Ridge, Dafla Hills, Assam, 4400 feet (*Godwin-Austen*).

Shell pyramidal, sharply keeled, a single raised rib on the periphery; sculpture distant very distinct transverse costulation, irregular longitudinal striæ below; colour very pale olivaceous brown;

spire high, sides flat; suture moderate; whorls 6, sides flat (species not quite fully grown); aperture semiovate; peristome thin, slightly reflected on columellar margin.

Size: major diam. 0·13 inch, alt. axis 0·11 inch.
,, 3·3 mm., ,, 2·8 mm.

Assimilates in its distinct costulation to the next species, but is much larger, with flatter sides, and is more pyramidal.

One specimen, Hengdan Peak, North Cachar Hills, about 8000 feet.

KALIELLA SUBCOSTULATA, n. sp. (Plate II. fig. 6.)

Locality. North Khasi Hills.

Shell pyramidal, umbilicus hidden: sculpture strong, well-defined (often distant) ribbing, also fine radiate ribbing on the base; colour pale sienna-brown; spire conic, sides very slightly convex, apex acuminate; suture moderately impressed; whorls 6, sides convex; aperture semilunate; peristome thin, slightly oblique near axis.

Size: major diam. 0·11 inch, alt. axis 0·08 inch.
,, 2·8 mm., ,, 2·0 mm.

KALIELLA PERAKENSIS, n. sp. (Nevill, MS.). (Plate II. fig. 7.)

Locality. Perak (*Dr. E. Townshend*).

Shell pyramidal, very narrowly umbilicated, keeled: sculpture fine, somewhat irregularly disposed, transverse costulation on the basal side, fine, close, regular, spiral or longitudinal ribbing; colour whitish grey: spire conoid, sides moderately convex, apex subacute; suture impressed; whorls 6, sides moderately convex; aperture semilunate; peristome rather thickened, strong, perpendicular or angulate below at the columellar margin.

Size: major diam. 0·15 inch, alt. axis 0·12 inch.
., 3·8 mm. ,, 3·1 mm.

KALIELLA FASTIGIATA, Hutton. (Plate II. fig. 8.)

Paper on the Land and Freshwater Shells of the Western Himalaya, by Lieut. T. Hutton, 37th Regt. N. I., and W. H. Benson, Esq., C.S., J. A. S. B. vol. vii. pt. 1, p. 217.

Type from Landour, N.W. Himalaya, Chemn. ed. Küster, *Helix*, p. 141, f. 15, 16.

Benson, Ann. & Mag. Nat. Hist. April 1859, p. 272.

Nevill, Hand-list (1878), p. 40. no. 190.

Conch. Ind. p. 8, pl. xvi. f. 5.

Th. Cat. Conch. Ind. p. 20.

Original description:—"*Testa parvula, albido-cornea, minutissime granulata, pyramidata, subtus plano-convexa; anfractibus septem, convexiusculis, ultimo acuto angulato, suturis leviter impressis; umbilico evanescente; apertura latiore quam longa; apice obtuso.*

"Axis 0·16 mm.

"Animal heliciform, greyish, darker on the tentacula. Found on dead leaves at Simla, in the *Khads* (ravines), and when in motion

carries its shell upright. It is not uncommon, but its smallness renders it difficult to collect (*H.*).

"It is more lengthened proportionally than either *H. turbiniformis* of Patargatha and Berhampore, alluded to in p. 357, vol. v. of this journal ...... The animal does not appear to exhibit the beautiful dark patches on a light ground which render that shell so conspicuous, when the animal is alive, by the appearance of the tints through the translucent shell (*B.*)."

Locality. Mussoorie, N.W. Himalaya (*G.-A.*).

Shell elongately pyramidal; sculpture, regular fine ribbing; colour pale brown: spire high, sides slightly convex; suture shallow; whorls 8, sides flatly convex; aperture semilunate; peristome thin, perpendicular on the columellar margin.

Size: major diam. 0·15 inch, alt. axis 0·14 inch.
,, 3·7 mm., ,, 3·8 mm.

Benson (*l. c.*) says "at Mussoorie and Landour *H. fastigiata* is not uncommon above 5000 and beyond 7000 feet elevation. I procured it most frequently creeping on the large wet leaves of *Saxifraga ciliata*, in damp and shady situations having a northern aspect."

Nevill (*l. c.*) records it from:—1. Mussoorie, Simla (*Stoliczka*); 2. Darjiling (*Stoliczka and Mainwaring*); 3. Arakan Hills (*Stoliczka*); 4. Naga Hills (*A. W. Chennell*); 5. Dafla Hills (*Godwin-Austen*). I have not identified any in my own collection from these two last-named localities, and I think no. 3 should be re-examined.

Kaliella elongata, n. sp. (Plate II. fig. 9.)

Locality. Raliang, Jaintia Hills (*G.-A.*).

Shell very elongately pyramidal, not umbilicated; sculpture, ribbing transverse at irregular intervals, some longitudinal or concentric striation near the umbilical region; colour pale ochraceous brown; spire very high, sides convex; suture shallow; whorls 10, sides rather convex; aperture semilunar, suboblique; peristome thin, reflected, and somewhat strong.

Size: major diam. 0·13 inch, alt. axis 0·20 inch.
,, 3·3 mm., ,, 5·0 mm.

Kaliella gratiosa, n. sp. (Plate II. fig. 10.)

Locality. Kopamedza Peak, Anghami Naga Hills, 8375 feet.

Shell globosely conoid, angulate on periphery and rounded below, very closely umbilicate; sculpture very fine regular transverse ribbing, also on the basal side, with a well-marked carination on the keel; colour pale horny brown; spire moderately high, conoid, blunt; suture well impressed; whorls 5, very convex; aperture semilunate, rounded below; peristome thin, slightly reflected, suboblique from axis.

Size: major diam. 3·5 mm., alt. axis 2·5 mm.

Kaliella nagaensis, n. sp. (Plate II. fig. 11.)

Locality. Kopamedza Peak, Anghami Naga Hills, 8375 feet (*G.-A.*).

Shell pyramidal, of thin texture, subperforate ; sculpture, regular distinct oblique costulation, radiating from umbilicus below ; colour pale horny brown ; spire high, conic, apex blunt, sides flat ; suture shallow ; whorls 6, sides somewhat convex, the last whorl keeled and with a distinct carination ; aperture semilunate ; peristome thin, slightly reflected near axis, and suboblique.

Size : major diam. 0·14 inch, alt. axis 0·10 inch.
,, 3·6 mm., ,, 2·6 mm.

Two specimens, Hengdan Peak, with sculpture finer.

Kaliella ? teriaensis, n. sp. (Plate II. fig. 12.)

Locality. Teria Ghat, southern base of Khasi Hills, about 300 feet.

Shell depressly pyramidal, rounded on base, narrowly umbilicated ; sculpture, on the upper whorls oblique transverse fine ribbing visible ; colour bleached ; spire conic, sides flat ; suture shallow, a thin fine raised beading following it ; whorls 5, flattened, the last sharply keeled ; aperture oblate ; peristome thin, the columella thickened and perpendicular, slightly reflected.

Size : major diam. 0·14 inch, alt. axis 0·08 inch.
,, 3·6 mm., ,, 2·0 mm.

EXPLANATION OF PLATE II.

(All figs. enlarged seven times.)

Fig. 1. *Kaliella barrakporensis*, Pfr.,=*sivalensis*, Hutton, var. Mussoorie, N.W. Himalaya.
2. —— *cherraensis*, G.-A. Teria Ghat, Khasi Hills.
3. —— *munipurensis*, G.-A. Munipur.
4. —— *jaintiaca*, G.-A. Marangsip Peak, Jaintia Hills.
5. —— *costulata*, G.-A. Tanir Ridge, Dafla Hills, north of Assam valley.
6. —— *subcostulata*, G.-A. North Khasi Hills.
7. —— *perakensis*, G.-A. Perak, Malay Peninsula.
8. —— *fastigiata*, Hutton. Mussoorie, N.W. Himalaya.
9. —— *elongata*, G.-A. Raliang, Jaintia Hills.
10. —— *gratiosa*, G.-A. Kopamedza Peak, Anghami Naga Hills.
11. —— *nagaensis*, G.-A. Kopamedza Peak, Anghami Naga Hills.
12. —— *teriaensis*, G.-A. Teria Ghat, base of Khasi Hills.

On the Subgenus *Microcystina,* with Descriptions of the Original and New Species.

(Plate III.)

This genus was first introduced, but without any description, by Prof. A. O. L. Mörch in his paper on the Shells of the Nicobar Islands, published in the 'Journal de Conchyliologie,' October 1872, p. 311; in the same Journal for October 1876, p. 356, its characters are given—" a little notch, narrow and very deep at the columellar margin;" and he compares it with *molecula*, Bs., from Burmah; but I cannot detect in this last any resemblance save in form and polished surface. The columella is not similar*. At the same time (in 1872) we find Prof. Mörch creating another subgenus, *Lithocystis*, on a species named *brunii* by him; but no description is given, *Helix gouldii*, Pfr., *milium*, Martens, and *cassidula*, Bs., being quoted as similar in form. In 1876 (*l. c.* p. 357), *Liocystis*, we are told, differs from *Microcystina* by the columella being twisted in S-form and not notched, and by an unpolished surface †.

The shell of *M. rinkii* is a small one, and the animal was not in a very perfect state, so that I am not able to give a very satisfactory description of its outer form, but it is sufficient to place it in a better position with regard to other genera.

Animal. The right shell-lobe was distinguished, and a long narrow left shell-lobe in two portions (fig. 3). The dorsal lobes were not made out. The extremity of the foot has a long pointed process above the mucous gland (fig. 4). The generative organs (fig. 5) were not all got at in a perfect state. The penis is long, with a slight short twist on the side next the vas deferens, and there is another rather swollen portion with a convolution lower down. The amatory organ, D, is also present.

The odontophore (figs. 7 & 7*a*) I am enabled to describe much more minutely, as it was dissected out very perfectly, the dental formula being—

$$35 \text{ to } 40 \,.\, 2 \,.\, 7 \,.\, 1 \,.\, 7 \,.\, 2 \,.\, 35 \text{ to } 40$$
$$= 44 \text{ to } 50 \,.\, 1 \,.\, 44 \text{ to } 50.$$

The central tooth is very long and sharp-pointed, with two sharp well-developed cusps on either side; the next seven medials are also very elongate and sharp, with a single cusp on the outer lower margin; in the eighth this is absent, being a plain unicuspid tooth; the next, the ninth, is bicuspid, with the outer cusp slightly shorter, these two being of transitional form; then follow the series of bi-

* Original description:—" Les *Microcystina* sont caractérisés par une petite échancrure, étroite et assez profonde, à la columelle, qui montre de faibles traces d'une dent obtuse. La coquille est polie sur toute sa surface. L'*Helix molecula,* Benson, de Birmanie, paraît très-analogue."

† Original description:—" Les *Liocystis* diffèrent des *Microcystina* par leur columelle tordue en S et non échancrée, et par leur surface non polie."

cuspid laterals, the points being blunt and rounded. The jaw (fig. 6) is semicircular in form, particularly well rounded on the side of the muscular attachment, while on the cutting-edge it is very convex, and with a well rounded central prominent projection.

The odontophore of this subgenus is therefore in every respect similar to that of *Macrochlamys*, Benson*; and the jaw, though more bent, is also of the same type.

This subgenus, therefore, I consider ranks very close to *Macrochlamys*, and must be placed at present next it. Whether its characters are sufficient to retain it, is a question that must be settled hereafter, when all these different genera are more closely examined. The shell (fig. 1) is of a solid texture, and the solid or very sinuate form of the columellar margin (fig. 2) is a distinct departure from the oblique and feebly-reflected columellar margin of *Macrochlamys*.

I hope to be able to examine before long some more spirit-specimens.

1. Microcystina rinkii, Mörch. (Plate III. fig. 1.)

Microcystina rinkii, Mörch, Journ. Conch. Oct. 1872, p. 311 ; id. Oct. 1876, p. 356 ; Nevill, Hand-list, p. 39. no. 171.

Locality. Island of Teressa, one of the Nicobars.

Shell closely umbilicate, subglobosely conoid, polished above; sculpture, very fine, regular disposed, and parallel longitudinal striæ, 26=·01 inch (fig. 1 *a*); colour rich sienna above, below covered with a dull white deposit ; spire subconoid, sides flat, apex blunt ; suture shallow ; whorls 5, the last well rounded ; aperture oblique, symmetrically lunate, the body-whorl covered with a distinct callus ; peristome thin, columellar margin (fig. 2) oblique, much thickened, reflected and very sinuate, the reflected portion ending abruptly at right angles to the base of the last whorl.

Size : major diam. 0·21 inch., alt. axis 0·10 inch.
,, 5·4 mm., ,, 2·6 mm.

For the animal of this species I am indebted to Mr. G. Nevill, to whom I owe many thanks for this and other rarities.

Original description (*l. c.* p. 311):—" *T. anguste umbilicata, convexo-depressa, tenuis, polita, nitidissima, brunnea, umbilicum versus pallidior ; striæ incrementi obsoletissimæ, remotissimæ ; spira parum elevata, obtuse convexa ; sutura obsolete appresso-marginata ; anfr.* 4, *vix convexi, angusti, ultimus subdepresso-rotundatus ; apertura obliqua, lunata, margine columellari (vel labro) dilatato, reflexo, profunde sinuato, fere emarginato, umbilicum propendente.*

" Diam. maj. fere 5 mill., axis $2\frac{3}{4}$ mill.

" *Hab.* Sambelong, bords de la rivière Galathea : trois exemplaires.

" *Obs. Nanina (Microcystis) mitiuscula*, v. Martens (Reise, p. 75, t. xii. f. 10) quoad formam."

L. c. p. 356 : " Habitat Sambelong (*Reinhardt*) ; Petite Nicobar (*Busch*, 1845) ; Kamorta, Teressa, Katchal (*Roepstorf*)."

* This genus I hope to describe and figure in the next Part.

Microcystina moerchiana, n. sp. (Nevill, MS.). (Plate III. fig. 9, ×4.)

Locality. Kondul Island, Bay of Bengal.

Shell subdepressly conoid, very polished; sculpture (fig. 9 *a*, ×50), very microscopic longitudinal fine striation, 32 = ·01 inch; colour reddish brown; spire flatly conoid; suture shallow; whorls 5, regularly increasing; aperture subovately lunate, subvertical; peristome thin, reflected at the umbilicus, solid and quite perpendicular at junction with body-whorl.

Size: major diam. 0·32 inch, alt. axis 0·15 inch.
,, 8·2 mm., ,, 3·8 mm.

Animal not known.

Microcystina warnefordi, n. sp. (Nevill, MS.). (Plate III. fig. 8, ×7.)

Microcystina warnefordi, Nevill's Hand-list, Dec. 1878, no. 168, = *Nanina* (*Microcystis*), n. sp., but not named.

Locality. Andamans.

Shell subdepressly conoid, narrowly umbilicate, glassy; sculpture (fig. 8 *a*, ×50), very fine regular microscopic longitudinal striæ; colour umber-brown; spire low; suture shallow, adpressed; whorls nearly 5, the last rounded on periphery; aperture lunate; peristome thin, columellar margin oblique, very slightly reflected, solid and angulate.

Size: major diam. 0·28 inch, alt. axis 0·08 inch.
,, 4·6 mm., ,, 2·0 mm.

Animal not known.

Microcystina harrietensis, n. sp. (Nevill, MS.). (Plate III. fig. 11, ×8.)

Locality. Mount Harriet, Port Blair, Andaman Islands.

Shell globosely conoid, narrowly umbilicated, rounded below; sculpture (fig. 11 *a*, ×50), fine regular longitudinal ribbing, crossed by rather regular lines of growth, but not decussate, 12 = ·01 inch; colour umber-brown; spire subconical, sides convex; suture impressed; whorls 4, last well rounded; aperture rather broadly lunate; peristome thin.

Size: major diam. 0·09 inch, alt. axis 0·045 inch.
,, 2·3 mm., ,, 1·3 mm.

Microcystina cryptomphalus, n. sp. (Nevill, MS.). (Plate III. fig. 10, ×7.)

Locality. Parisnath Hill, Hazaribagh, Lower Bengal, 4480 feet.

Shell narrowly umbilicate, depressly conoid, flat on base; sculpture, regular fine parallel spiral striation or grooving, 20 = ·01 inch; colour pale brown; spire subconical; whorls 5, regularly increasing; aperture lunate; peristome thin, reflected and angulate at columellar margin.

Size: major diam. 0·12 inch, alt. axis 0·06 inch.
,, 3·1 mm., ,, 1·5 mm.

EXPLANATION OF PLATE III.

Fig. 1. *Microcystina rinkii*, Mörch, × 8.
1 *a*. ——— ——: sculpture, × 50.
2. ——— ——: columellar margin, × 20.
3. ——— ——: part of mantle, × 8. *r.d.l.*, right dorsal lobe; *l.d.l.*, left dorsal lobe.
4. ——— ——: extremity of foot, × 8. From spirit-specimen.
5. ——— ——: generative organs. *P.*, male organ; *Sp.*, spermatheca; *vd.*, vas deferens; *D.*, dart-sac.
6. ——— ——: jaw, × 50.
7. ——— ——: teeth of the radula, central, median, and lateral, × 1210.
7 *a*. ——— ——: ditto, ditto, × 360.
8. —— *warnefordi*, n. sp., × 7.
8 *a*. ——— ——: sculpture, × 50.
9. —— *moerchiana*, n. sp., × 4.
9 *a*. ——— ——: sculpture, × 50.
10. —— *cryptomphalus*, n. sp., × 7.
10 *a*. ——— ——: sculpture, × 50.
10 *b*. ——— ——: columellar margin, × 20.
11. —— *harrietensis*, n. sp., × 8.
11 *a*. ——— ——: sculpture, × 50.

On the Land-Molluscan Genus *Cryptosoma*, and Description of the Animal of *Cryptosoma prœstans*, Gould.

(Plate IV.)

The genus *Cryptosoma* was created in 1857 by Mr. W. Theobald, of the Indian Geological Survey, for a shell common at Moulmain, named *Vitrina prœstans* by Gould. Mr. Theobald's original description in the J. A. S. Bengal, no. iv. p. 252, is very brief, and runs thus:—"*Testa vitrinæ simile, sed robustiore. Peristomate obtuso haud tenui. Animale penitus intra testam retractile, et, in æstivationis tempore, solido epiphragmate obtecto.*

"*C. prœstans* (*Vitrina prœstans*), Gould. Maulmain, Martaban, Tenasserim valley. I have separated this shell from *Vitrina*, as the animal is perfectly retractile, and the peristome is thicker than in *Vitrina* proper, and not membranous. It is common in holes in laterite at Martaban, and not rare throughout the Tenasserim valley. Its colour is a bay-olive Cajiput green."

The genus was therefore founded partly on the characters of the animal, and is therefore far better than the meagre shell-characters on which so many genera have been created. It is curious the truncate form of the foot with the mucous pore was not also mentioned, which is the principal outward character that distinguishes it from *Vitrina* with its long pointed foot. I had long wished to get a specimen of the animal of this species, its shell being peculiar,

so unlike the other species of *Helicarion*, with which it has been classed by other conchologists since; even Mr. Theobald himself, in his 'Catalogue of the Land and Freshwater Shells of British India,' puts it in his section E of *Helicarion*. *H. ovatus*, H. Blanford, and *succineus*, Reeve, are also included in this section, but on no tangible grounds.

Geoffrey Nevill, in his "List of the Mollusca brought back by Dr. J. Anderson from Yunnan and Upper Burmah," J. A. S. Bengal, part 2, 1877, p. 25, recognizes the genus *Cryptosoma* with these remarks:—

"The entire shell is covered with a thick and compact epidermis; the largest specimen in the Museum (Calcutta), from Tenasserim, measures, axis $27\frac{1}{2}$, diam. $31\frac{1}{4}$ mil. It is an extremely abundant species in Tenasserim and also near Moulmein; Dr. Anderson found it abundant at Sawady and on the banks of the Irrawady, Second Defile." The shell, with animal, was also figured in Dr. Anderson's work from a drawing made, under Dr. Ferd. Stoliczka's superintendence, by a native artist, and which I give a copy from the same original excellent drawing (Plate IV. fig. 1).

Vitrina præstans, from Tavoy (Gould), P. Bost. Soc. N. H. vol. i. p. 140, read Sept. 6 (1843).

Vitrina præstans, Gould, Boston J. Nat. Hist. vol. iv. p. 456, plate 24. f. 2, read Sept. 6 (1843); Pfeif. Mon. Helic. vol. ii. p. 497 (1848); Reeve, Conch. Icon. *Vitrina*, f. 12 (May 1862); Theobald and Hanley, Conchologia Indica, plate lxv. figs. 5, 6 (1870), with remark "our fig. 6 is scarcely round enough."

Cryptosoma præstans, Maulmain, Martaban, and Tenasserim valley (W. Theobald), J. A. S. B. p. 252 (1857).

Helicarion (Section E) *præstans*, Theobald, Cat. Land and Freshwater Shells of British India (1876).

Helicarion (*Cryptosoma*) *præstans*, Nevill, J. A. S. B. part ii. p. 25 (1877).

Helicarion præstans, G. Nevill, Hand-list of Mollusca in Ind. Mus., Calcutta (1878).

Original description:—"*Testa depressa, fragili, nitida, straminea; anfr. tribus, striis incrementi, et volventibus reticulatis; apertura subcoarctata.*"

The colour is dark straw-colour or amber-colour, inclining to green. A thin layer of enamel unites the two extremities of the lip. The figure given is very good.

In response to a wish I expressed in a paper in the Linnean Society last year, Mr. Theobald most kindly sent me quite lately a couple of specimens, preserved in glycerine, of this species from Maulmain. I am now able to give a somewhat more detailed account of its forms and anatomy, which gives it a more substantial position as a subgenus by itself, and which must, with our present knowledge, be recognized.

Animal (Plate IV. fig. 2). With tentacles rather short and blunt, the extremity of foot truncate, the mucous pore large, but with no

overhanging lobe, the pedal line very distinct and segmented, terminating at the upper margin of the mucous gland, the foot with a broad pedal margin, segmented (fig. 6). Mantle—the right shell-lobe is moderately large and extends over the region of the body-whorl (Plate IV. fig. 2); it extends quite round to the posterior margin (figs. 4, 5), and unites with the left shell-lobe, which is very long and well developed (fig. 3), and spreads over the edge of the peristome from near the respiratory orifice. The right dorsal lobe is triangular in shape, and the left dorsal lobe is long and rather narrower than the shell-lobe adjacent. The genital organs in one specimen were very small and undeveloped, and were not very well developed in the second specimen; they show the presence of a thick bluntly cylindrical amatory organ (dart-sac) (fig. 9, D). The penis is much convoluted, and is closely folded together, having a cæcum-like process (kalk-sac) (fig. 10, *c.c.*) midway between the vas deferens and the retractor muscle, exactly as in *H. bicarinatus*, Semper, and *H. ceratodes*, Pfr., from Luzon, but which have no amatory organ. The ovo-testis, hermaphrodite duct, &c. were not made out. *Helicarion cumingi* is also somewhat similar, and possesses this organ.

Odontophore (Pl. IV. fig. 12). The buccal mass is large, the radula is nearly as broad as long, with a very large number of teeth in each row. The ribbon was delicate, and was broken in taking it out; but 88 rows were counted in one specimen and 97 in the second: we may take 100 as the probable number. The dental formula is

$$120\ (2+7)\ .\ 1\ .\ (7+2)\ 120,$$
$$\text{or}\quad 130\ .\ 1\ .\ 130.$$

The central tooth is broad, large, bluntly pointed, with two small basal cusps on either side, on a broad oblong base. The next median eight are large, broad, and sharp-pointed, but decreasing in breadth outwards; each has one short basal cusp on the outer margin. Each median has a small notch on the inner margin, its position halfway between the apex and the outer cusp. In No. 8 it is still nearer and is less developed. In No. 9 it is hardly to be seen; the tooth is narrower, while the outer basal cusp has advanced its position close up to the point, and No. 10 is changed completely into a long, narrow, bicuspid lateral. More than one hundred such teeth succeed, all of the same size and shape; then the points become blunter (fig. 12 *a*), with only an indication of the bicuspid form, and finally the last have a single, blunt, rather square point (fig. 12 *b*), and the outermost diminish much in size and are short and pointed. This radula is therefore very peculiar, assimilating to that of *Macrochlamys* on one side in the general character of the well-developed median teeth, but differing widely in the very great number of the laterals, the formula of *Macrochlamys* being

$$40\ \text{to}\ 50\ .\ 12\ .\ 1\ .\ 12\ .\ 40\ \text{to}\ 50,$$
$$\text{or}\quad 55\ .\ 1\ .\ 55.$$

The jaw is strong, straight in front, and longitudinally striate, thus differing again from *Macrochlamys* and its allies (*Girasia*,

Austenia, &c.), which have a central convex projection on the frontal edge. In the great number of teeth it recalls the genus *Durgella*, which also has a straight jaw.

The odontophore is very similar to *Helicarion ceratodes*, Pfr., from Luzon, given by Dr. C. Semper in Reis. Archipel Philippinen, pl. vi. fig. 24; and the animal on plate i. fig. 12 is also very like, but does not show the form of the right shell-lobe.

EXPLANATION OF PLATE IV.

Fig. 1. Animal of *Cryptosoma præstans*, from nature, nat. size. Copied from an original drawing made by native artist, under the superintendence of the late Dr. F. Stoliczka.
2. Animal (enlarged), from spirit-specimen, viewed from right side. Shell removed, showing the mantle and its lobes.
3. Ditto, left side.
4. Ditto, posterior side, viewed from above, showing the junction of the shell-lobes.
5. Ditto, side view.
6. Anterior portion, underside of foot, showing the segmented pallial margin.
7. Side view of extremity of foot.
8. Generative organs.
9. Ditto, second specimen.
10. Male organ, showing the cæcum or kalk-sac.
11. Jaw, × 20.
12. Teeth of lingual ribbon, × 360.
12 *a*. Laterals, about the 100th from central tooth.
12 *b*. Outermost laterals.

LAND AND FRESHWATER MOLLUSCA

OF

I N D I A.

Part II.—JULY 1882.

Family ZONITIDÆ.

Subgenus KALIELLA (*continued*).

(Plate V.)

KALIELLA BARRAKPORENSIS, Pfr.

Additional synonymy:—Cat. Pulm. B. M. p. 80 (*Nanina*); Reeve, Conch. Icon. n. 816, t. 132.

Since the publication of Part I. I am enabled to give a description of the lingual ribbon of this species. The dried-up animal, a mere speck, still remained in a specimen from Barisal (Part I. p. 3). By soaking this in glycerine for some days, I was rewarded by finding the lingual ribbon, and getting the greater part of it out (*vide* Plate V. fig. 11). This confirms Stoliczka's remarks on the difference of its dentition as compared with *Sitala*, Adams, when describing that genus under the title *Conulema*. The dental formula is

26 . 7 . 1 . 7 . 26
33 . 1 . 33

The central tooth is tricuspid on an oblong base; the central cusp very long, narrow, and sharp-pointed, the lateral cusps about half as long, also lengthened and sharp. The next seven median teeth are similar in form, with the basal cusps having a tendency to turn outwards. The central point is rather shorter in 6 and 7, which last is broader than any of the other median teeth. At the eighth the form quite changes into a narrow, elongate, curved, still tricuspid

tooth, the inner cusp being slightly longer than the median, and that again than the outer. The laterals decrease rapidly in size to the outermost, which are small, short, and tricuspid (fig. 11 *a*).

Benson was the first to discover this shell. He notes finding it at Patharghata in September, and also at Berhampur (J. A. S. B. 1836, p. 357).

In continuation of what has been recorded of this species (pp. 2, 3, 4), I may mention that I have seen the two examples in the British Museum, marked from India only, the types described by Pfeiffer out of the Cuming collection. They have all the appearance of specimens from Mussoorie. In the same collection are a number sent from that part of India by Captain T. Hutton, who distributed this shell to several collectors about the same time. They are of the sienna-brown colour which is characteristic of the N.W. Himalayan form (*sivalensis*).

Benson, in the Ann. & Mag. Nat. Hist., May 1863, records that this species was obtained by Mr. F. Layard at Kandookerre, in Lower Ourah, Ceylon. I have not seen any myself from that part of India.

The most interesting and remarkable fact in distribution is the occurrence of the genus *Kaliella* in Madagascar. My attention has been only lately drawn to this by Mr. Edgar Smith, of the British Museum, who obtained the specimens from Mr. W. Johnson, who collected them at a place "in the outskirts of the upper forest, 28 miles east of Antananarivo," the capital of the island. Mr. Edgar Smith has kindly sent me a specimen, and having compared it side by side with species from different parts of India, I found it agreed very closely with the Nilgiri variety in Mr. W. T. Blanford's collection which I named *sigurensis*. From the N.W. and East-Himalayan forms it differs in the columellar margin being less oblique, and the peristome more rounded below, giving a larger aperture. It measures in major diam. 3·6, alt. axis 2·9 millim. The Madagascan *Kaliella* can therefore stand as *K. sigurensis*, or as *K. barrakporensis*, var. *sigurensis*, or simply var. No two naturalists are agreed as to where a variety ends and a species begins; in fact there is no defined line; I prefer, however, when there is a decided change of form in some character or another, and constant over a separate area, to distinguish such forms by a name. It is this gradual change which is so interesting when studying and following out any group over a wide extent of country.

Mr. Johnson says, "It was not in or near any garden or human habitation, nor could any introduced plants have got there." He found them "on the ground, among bracken fern, in a scrap of forest. A fire had passed over the place a year (?) previously, and these shells were hidden among the light black earth and leaves, on high ground, above a cliff or brow of rock, below which was thick forest." The shells were very scarce, he "could only find a few specimens, except blanched ones." This account certainly supports the view that the shell has not been introduced; and we may consider it one of the several forms that formerly had a far more ex-

tensive and similar range from this island towards India on the north-east. The paucity of these genera and species, however, points to a very distant and not a very close and continuous connexion.

KALIELLA FASTIGIATA, Hutton. (Plate II. fig. 8.)

Additional synonymy:—Wiegm. Arch. (1839) ii. p. 222; Reeve, n. 823, t. 133; Pfr. Mon. Hel. i. p. 37. no. 57, and iii. p. 41. no. 85; Chem. ed. Küster, *Helix*, n. 919, t. 141. figs. 15, 16; Mon. Suppl. p. 40; Cat. Pulm. B. M. p. 75 (as *Nanina*).

I next figure, on Plate V., a group of minute shells, of which the animal has never been examined, nor have I any notes of my own regarding them. The sculpture is similar to species already figured, viz. fine transverse ribbing; they are conoid or globosely conoid in form, and rounded or subangular on the periphery, instead of being sharply keeled, and the whorls are more convex. Of this subgroup *Helix nana*, Hutton, may be taken as the type. I hesitate, at present, to give the group any distinctive title, and shall bring them in under *Kaliella*, to which, I think, they will be found to be nearest related; and should this prove to be the case, it will be better to slightly amend the characters of the above genus as originally described by Mr. W. T. Blanford, than to create a new subgenus. I hope to receive specimens in spirit from the N.W. Himalaya of *nana* and *bullula*, which will clear up the question whether they are or are not allied to *K. barrakporensis*.

KALIELLA NANA, Hutton. (Plate V. figs. 6, 6*a*.)

Helix nana, J. A. S. B. March 1838, vol. vii. p. 218; Conch. Indica, p. 28, pl. lxi. figs. 7, 8, 9.

Sitala nana, Theob. Cat. p. 20.

Nanina (*Microcystis*) *nana*, Nevill's Hand-list, p. 38. no. 164; Cat. Pulm. Brit. Mus. p. 74 (1855).

Orobia nana, Die Heliceen (ed. von Martens), p. 58 (1860).

Original description:—"*Testa parvula, convexo-conoidea, pallide fucescente; anfractibus sex aut septem arcte convolutis, ultimo rotundato; apertura latiore, labro simplici; umbilico evanido; apice valde obtuso.*

"Diam. 0·1.

"Animal Heliciform, colour dark grey. Accompanies the two last species (*fastigiata* and *bullula*), and occurs in the greatest abundance." (*B.*)

Range. Simla, Mussoorie (*Dr. T. Oldham and Stoliczka*). Darjeeling (*Stoliczka and Col. Mainwaring*): I have never seen this shell, which may not be the same species. Moisraka, Midnapur district (*G. Nevill*), and Botanical Gardens, Calcutta (*Stoliczka*); Port Canning (*Wood Mason*): regarding these three Lower Bengal localities, there is, I think, some doubt as to the correct identification of the shells.

Locality. Mussoorie, N.W. Himalaya (*G.-A.*): figured.

Shell very globosely conoid, rounded on the base; sculpture very

fine, regular, sharply defined transverse ribbing, quite smooth to the eye; colour pale ochraceous; spire conoid, sides convex; apex blunt; suture well impressed; whorls 6, sides convex; aperture lunate; peristome thin, oblique on columellar margin.

Size: major diam. 0·12 inch, alt. axis 0·08 inch.
,, 3·0 mm., ,, 2·0 mm.

Kaliella resinula, n. sp. (Plate V. fig. 8.)

Locality. Khasi Hills (*G.-A.*).

Shell globosely conoid, very closely umbilicate, rounded below; sculpture beautifully fine close costulation; colour pale ochraceous; spire high, sides much convex; suture impressed; whorls 6, convex, regularly increasing; aperture semilunate; peristome thin.

Size: major diam. 0·09 inch, alt. axis 0·08 inch.
,, 2·4 mm., ,, 2·0 mm.

Kaliella resinula, juv. (Plate V. fig. 7.)

Locality. Teria Ghat (*G.-A.*).

Shell globosely conoid, very closely umbilicate, rounded below; sculpture very fine transverse costulation; colour pale horny; spire moderately high, sides convex; suture impressed; whorls 5, convex, regularly increasing; aperture semilunate, nearly vertical; peristome perpendicular near axis.

Size: major diam. 0·08 inch, alt. axis 0·06 inch.
,, 2·0 mm., ,, 1·6 mm.

Kaliella sikkimensis, Nevill, MS. (Plate V. fig. 9.)

Locality. Sikkim, ex Indian Museum, Calcutta.

Shell ovately conoid, rounded below, closely umbilicated; sculpture extremely fine, close, regular costulation; colour pale sienna-brown; spire blunt and rounded; suture impressed; whorls 6, sides convex; aperture semicircular; peristome sharply reflected near the umbilicus.

Size: major diam. 0·095 inch, alt. axis 0·08 inch.
,, 2·3 mm., ,, 2·0 mm.

This is very close to the Khasi shell *resinula*, but is not so tumid.

Kaliella lhotaensis, n. sp. (Plate V. figs. 2, 2*a*.)

Locality. Lhota Naga (*A. Chennell*).

Shell globosely conoid, not umbilicated, subangular on last whorl, base rounded; sculpture delicate, regular, fine transverse ribbing, quite smooth below; colour pale sienna-brown; spire conoid, sides convex; suture shallow; whorls 5, regularly increasing; aperture oblique, ovately lunate, small; peristome moderately thickened; columellar strong, perpendicular.

Size: major diam. 0·09 inch, alt. axis 0·06 inch.
,, 2·3 mm., ,, 1·6 mm.

This shell is at first sight very like *animula* from the Khasi Hills, but its small semicircular aperture is very different from the larger open one of that shell.

Kaliella flatura, n. sp. (Plate V. figs. 10, 10*a*.)

Locality. Munipur (*G.-A.*).

Shell globosely conoid; sculpture regular, well-marked, transverse ribbing, not apparent to the eye; colour horny brown; spire high-conoid, sides slightly convex; suture impressed; whorls 5, sides convex; aperture ovate, vertical; peristome thin, a good deal reflected and perpendicular on columellar margin.

Size: major diam. 0·09 inch, alt. axis 0·06 inch.
,, 2·3 mm., ,, 1·5 mm.

Near *lhotaensis*, but more globose, whorls more convex, blunter apex and coarser ribbing.

Kaliella animula, n. sp. (Plate V. fig. 1.)

Locality. Khasi Hills (*G.-A.*).

Shell pyramidal, somewhat rounded below, angular on periphery; sculpture oblique, irregular ridges of growth, with very minute transverse ribbing; colour pale horny; spire conoid, sides flat; suture moderately impressed; whorls 5, sides convex; aperture broadly ovate, subvertical; peristome thin; columellar margin but slightly reflected and very upright.

Size: major diam. 0·1 inch, alt. axis ·075 inch.
,, 2·6 mm., ,, 1·9 mm.

Kaliella bullula, Hutton. (Plate V. fig. 4.)

Helix bullula, J. A. S. B. March 1838, p. 218; Reeve, n. 819, t. 133; Conch. Ind. p. 28, pl. lxi. figs. 2, 3.

Sitala bullula, Theob. Cat. p. 20.

Nanina (*Microcystis*) *bullula*, Nevill, Hand-list, p. 37. no. 155: Naini Tal, Simla, Kulu, and Mussoorie (*Stoliczka*).

Nanina bullula, Cat. Pulm. Brit. Mus. p. 88 (1855).

Orobia bullula, Die Heliceen, ed. von Martens, p. 58.

Original description:—"*Testa parvula, glabra, translucente, subtrochiformi, conoidea; anfractibus quinque convexis, ultimo rotundato; suturis impressis; umbilico angustato; apertura latiore; labro simplici.*

"Diam. 0·15 inch (*B.*).

"Found with *H. fastigiata* among dead leaves at Simla. This shell is much larger than *nana*, with which it has been mistaken."

Locality. North side of the Nag-Tiba range, near Mussoorie, N.W. Himalaya (specimen figured).

Shell bluntly conoid; sculpture fine, regular, transverse ribbing, with no longitudinal furrows, as in *rimicola*; colour pale whitish horny; whorls 5, sides convex, somewhat subangulate on the periphery, the last somewhat descending; columellar margin suboblique.

Size: major diam. 4·0 mm., alt. axis 3·0 mm.
,, 0·16 inch, ,, 0·12 inch.

In Mr. W. T. Blanford's collection there are three examples of

this species from Kumaon, which only differ in being smaller than those from Mussoorie (*vide* Plate V. fig. 5). Major diam. 3·5; alt. axis 2·1 mm.

EXPLANATION OF PLATE V.

Fig. 1. *Kaliella animula*, n. sp., × 7. Khasi Hills.
2. —— *lhotaensis*, n. sp., × 7. Lhota-Naga Hills.
2*a*. —— ——: sculpture, × 50.
3. —— *barrakporensis*, Pfr., × 7. Madagascar.
4. —— *bullula*, Hutton, × 7. North side Nag-Tiba range.
5. —— ——, × 7, small var. Kumaon, N.W. Himalaya.
6, 6*a*. —— *nana*, Hutton, × 7. Mussoorie, N.W. Himalaya.
7. *Kaliella resinula*, juv., n. sp., × 7. Teria Ghat, Khasi Hills.
8. —— *resinula*, n. sp., × 7. Khasi Hills.
9. —— *sikkimensis*, Nev. MS., × 7. Sikkim.
10, 10*a*. —— *flatura*, n. sp., × 7. Munipur.
11. Teeth of the radula of *Kaliella barrakporensis*, Pfr., from a specimen from Barisal, Lower Bengal: central and twelve laterals. 11*a*. Outermost laterals, × 1250.

The characters of the subgenus *Kaliella* have never been drawn up. They are indicated below, with a synoptical list of the species I would include in it.

Character.	Name.	Locality.
A. Shell trochiform or pyramidal, with sides flat, well keeled on periphery; base flat, with transverse or oblique very fine costulation; subperforate. Animal with a mucous pore. Anatomy similar to the genus *Sitala*. Odontophore, central teeth oblong, sharp-pointed, with tricuspid laterals.		
a. Major diameter > than height of spire	*barrakporensis* ...	Lower Bengal, Darjiling, Himalaya.
	——, var. *sivalensis*	Mussoorie and N.W. Himalaya.
	——, var.	Madras.
	perakensis	Malay Peninsula.
	vulcani	Burmah.
a′. Spire = or > major diam....	*sigurensis*	Nilghiris.
	——, var.	Madagascar.
	cherraensis	Khasi Hills.
	——, var.	Lower Bengal.
a″. Strong distant costulation	*costulata*	Dafla Hills, Assam.
	subcostulata	N. Khasi Hills.
b. Spire high, sides convex, subangulate on periphery	*munipurensis* ...	Munipur.
	——, var.	Naga Hills.
	aspirans	Nilghiris.
	khasiaca	Khasi Hills.
b′. Spire higher	*fastigiata*.........	N.W. Himalaya.
	elongata	Khasi Hills.

Synoptical List (*continued*).

Character.	Name.	Locality.
c. Base tumid below	*jaintiaca*	S. Jaintia Hills.
	nagaensis	Naga Hills.
	gratiosa	Ditto.
	teriaensis	Khasi Hills.
B. Shell globosely conoid; sides convex; aperture small, subperforate; close fine transverse costulation.		
d. Rounded on last whorl	*nana*	N.W. Himalaya.
	resinula	Khasi Hills.
	sikkimensis	E. Himalaya.
	bullula	N.W. Himalaya.
	flatura	Munipur.
c′. Subangulate on periphery	*lhotaensis*	Lhota-Naga Hills.
	animula	Khasi Hills.

Genus Sitala.

Sitala, H. Adams, P. Z. S. April 1865, p. 408.

In a paper entitled "List of the Land Shells collected by Mr. Wallace in the Malay Archipelago, with Descriptions of the new Species by Mr. Henry Adams," under *Trochomorpha tropidophora*, Ad. & Reeve, from Borneo, is the following note:—

"From the observations of Mr. W. T. Blanford, the animal of *T. lychnia* is without a mucous pore at the extremity of the foot; and *Trochomorpha* therefore must be removed from the family Stenopidæ. The species *infula*, Bens., however, hitherto included in *Trochomorpha*, is, according to Mr. Blanford, furnished with one, and must remain in that family, where it may be considered the type of a group, under the name of *Sitala*."—*H. Ad.*

The genus was therefore, under this title, never thoroughly described; but it is sufficiently well indicated, and it was very necessary to remove *infula* from the subgenus *Trochomorpha*, in which Albers had originally placed it.

Ferd. Stoliczka, in ignorance of the very brief note by Adams*, described this genus most thoroughly and accurately under the name of *Conulema*, in that very elaborate and excellent paper on "Terrestrial Mollusca from the Neighbourhood of Moulmein," in the Journ. Asiat. Soc. Bengal, 1871, p. 236, taking *attegia*, Bs., for his type, and including *culmen*, Blf., *infula*, *cacuminifera*, *arx*, and *palmaria*, Benson, *H. gratulator* and *confinis*, Blf., *liricincta*, Stol., probably *N. apicata* and *H. hyphasma*, Pfr., from South India and Ceylon, *H. leucophlœa*, Martens, from Celebes, and a few others. Stoliczka says also, "The genus is, as regards form and structure of the shell, closely allied to Semper's *Martensia* (a name already employed in botany) (Reisen im Archipel der Phil. &c., Theil 2, Band iv. p. 42); but in this the light shell-lobe of the mantle is said to be

* And he acknowledges this when describing *Sitala carinifera*, in J. A. S. B. 1873, p. 16, saying *Conulema* must now be regarded as identical with *Sitala*.

entirely absent, and the penis has two cæcal appendages, which have not been observed in *Conulema*." I give Stoliczka's description in full:—

"Shell conoidal, thin, consisting of many, usually spirally ribbed or striated whorls; base convex, narrowly or indistinctly umbilicated; margin of the aperture thin, not expanded, outer simple.

"Animal narrow, long, generally equal to twice the greater diameter of the shell; pedicles long, tentacles much shorter, lateral line distinct, the margin below it smooth; gland at the end of foot large, superseded by a distinct horn; sole grooved; two shell and two dorsal lobes to the mantle, all of them small and with no separately produced appendages, but slightly extended on either end; genital organs with or without an amatorial gland; a single appendage to the penis, produced into the penis retractor, receptaculum seminis terminating with a bulging end, attached to the anterior portion of the prostata. Jaw thin, transparent, smooth, indistinctly or finely concentrically striated in the middle. Radula large, consisting of numerous (about 100) transverse rows, each with very numerous (300 to above 400) teeth, a few median teeth being conspicuously larger than the laterals, which are narrow, pectiniform, and very gradually decreasing in width."

Sitala infula, Bs. (Plate VIII. fig. 1.)

Helix infula, Benson, Ann. & Mag. N. H. Sept. 1848, p. 160, changed from *H. tubiniformis*, J. A. S. B., type described from Murshedabad and Patharghata, Behar; Reeve, Conch. Icon. *Helix*, f. 783; Pfr. Mon. Hel. vol. iii. p. 58; Conch. Ind. pl. liv. fig. 9; Chem. ed. ii., *Helix*, n. 804, t. 127. f. 24, 25; Mon. Suppl. p. 58.

Trochomorpha infula, Albers, Die Heliceen, 2nd edit. von Martens (1860), p. 61; W. T. Blanford, Ann. & Mag. N. H., Feb. 1863.

Nanina infula, J. E. Gray, Cat. Pulm. B. M. p. 80 (1855).

Sitala infula, Theob. Suppl. Cat. p. 20.

Nanina (*Sitala*) *infula*, Nev. Hand-list, 1878, p. 33, =*culmen*, Blf.

Original description:—"*Testa subperforata, globoso-conica, subtrochiformi, albido-cornea, pellucida, supra minime nitente, lineis distantibus parum elevatis cincta, subtus subnitente, radiato-striata, striis remotiusculis concentricis ornata* [Pl. VIII. figs. 1 *a*, 1 *b*]; *spira subconica, apice obtuso; anfractibus sex convexiusculis, ultimo angulato, infra convexiusculo; apertura subquadrato-lunata, peristomate acuto, margine columellari verticali, prope perforationem subreflexo.*

"Diam. maj. 7 mill., axis 5 mill.

"*Hab.* prope urbem Murshedabad Bengaliæ, necnon prope collem Patharghata, provinciæ Behar.

"Formerly indicated as *H. turbiniformis*, mihi, in the 'Journal of the Asiatic Society of Calcutta.' This name being used by Pfeiffer for another species, I have altered it for one of nearly similar signification. *H. infula* occurred to me in 1835 on the leaves of trees and shrubs at the two places above noted. The animal has a caudal protuberance like *Nanina*, but no expansion of the mantle, and is

whitish, spotted with brown, which, appearing through the translucent shell, gives the species a beautiful appearance when newly captured. At first sight it appeared as if the colours resided in the shell."

Specimen figured ex. coll. W. T. Blanford, from Calcutta.

Major diam. 8·0, alt. axis 5·5 mm.

The largest specimen I have seen in same collection, from Talchir, measures—major diam. 8·5, alt. axis 7·0 mm., showing how these local races or varieties differ. On a close examination of four Calcutta specimens, seven distinct spiral ribs, crossed by fine transverse oblique costulation, were counted, the ribs being less distinct on the last whorl. In the two specimens from Talchir this spiral sulcation is much wider apart, and only five could be counted on each whorl.

Stoliczka (*l. c.* p. 239) thus describes *S. infula* in detail; and I have copied the animal with its anatomy, and that of *S. attegia* given on plate xviii., which illustrates his paper :—

"The animal of this species [Pl. VIII. fig. 1 *c*] is identical in form and coloration with that of *attegia*, except that there is often a little more leaden grey on the upper posterior part of the foot, tinging the sole. The general organization is also the same in both, with the only difference that in the genital organs the amatorial sac is entirely absent. The end of the seminal receptacle is attached by a fine thread to the anterior part of the prostata, and the albuminous gland of the uterus is comparatively larger than in *attegia*. In specimens which I examined in winter, the oviduct was anteriorly only slightly enlarged; but all the larger specimens examined during the rainy season showed a very conspicuous orange-coloured swelling in that place [Pl. VIII. fig. 1 *g*]. The ova composing it were in an advanced state of development, and some of them showed already a spiral arrangement of dark corpuscles.

"The jaw [fig. 1 *d*] exhibits a rather distinct but very fine concentric striation; the median projection in the anterior concavity is very slight, and the convex edge is partially soft, granular, not entirely horny.

"The radula [fig. 1 *e*] is large, composed of about 100 nearly straight transverse rows, each generally consisting of from 307 to 321 teeth, the seven median teeth being conspicuously larger than those following on either side, the formula being

$$150+3\ .\ 1\ .\ 3+150$$
$$153\ .\ 1\ .\ 153$$

and the total number of teeth is somewhat above 30,000.

"The anatomy of the present species [fig. 1*f*], when compared with that of the last (*attegia*), agrees, as already stated, almost perfectly. There is a slight difference in the terminal attachment of the seminal receptacle and in the number of enlarged teeth, but the only essential distinction lies in the absence of an amatorial sac in *infula*. I was at first inclined to attribute the absence of that

organ to immaturity; but this view was not supported by the examination of specimens at all seasons of the year, and some which had fully-developed ova. The only conclusion I can arrive at is that the presence or absence of an amatorial sac cannot be considered as a character of generic importance; for it would be simply dragging classification into absurdity if we would refer *infula* and *attegia* to two genera, while almost every other point of organization, the form and colour of the animals and of the shells are nearly perfectly the same."

I can bear out Stoliczka in these remarks; for when examining two species of the genus *Durgella*, which is closely allied to *Sitala*, and which I described in the Linnean Society's 'Journal,' vol. xv. 1881, p. 291, I pointed out that the Tenasserim form *D. levicula* possesses an amatory organ, while in *D. assamica* it was absent, yet in every other character there was similarity between them; and I subsequently found that a third species (*D. christianæ* from the Andamans) was also deficient of this organ, still preserving the main characters of the genus *Durgella*.

" *C. infula* is a common species in the neighbourhood of Calcutta; it occurs sparingly in Western Bengal, and northwards up to the foot of the hills, and is also found near Poona and Balarampúr in Southern India. In none of these localities do the specimens attain the size of the Burmese *attegia*; and when compared with ordinary specimens of the latter, *the spiral angle is generally found to be smaller*, *the whorls slightly more convex*, *and the base of the last less inflated*. However, these characters are all somewhat variable; and I collected specimens of *attegia* at Moulmain which are almost undistinguishable from the Bengal *infula*, the only difference being that the former are clearly immature, while the latter, of the same size, have all the appearance of full-grown shells." The above comparative description of the two forms (the italics are mine) is clearly shown in the figures I give of them, and to this can be added the difference in their sculpture. Nevill, in his 'Hand-list,' records twenty specimens of *infula* from Moulmain, ex coll. Stoliczka; these are probably the immature specimens of *attegia* referred to above: he, at the same time, records *S. culmen*, Blf., as a synonymn of *infula*, while, as I shall show further on, Stoliczka considered *culmen* to be the young of *attegia*, which, if it is not distinct, is a much more reasonable conclusion.

"The following measurements have been taken from specimens of different localities:—

	Calcutta.	Ranigunj.	Poona.
Number of whorls	$6\frac{1}{2}$	7	$5\frac{1}{2}$
Larger diameter	7·0 mm.	7·5 mm.	5·5 mm.
Smaller ,, ...	6·5 ,,	7·0 ,,	5·5 ,,
Height of shell	7·0 ,,	7·3 ,,	5·5 ,,
Spiral angle	72°	74°	78°

" I have not seen, from any part of Bengal, specimens larger than

8 mm. in the greater diameter, and those from the Western Ghats appear rarely to attain more than 6 mm. in the same diameter. The spiral angle varies in the Bengal specimens from 65°–78°; on the average it is decidedly smaller than in *attegia*, and may be taken at 74°."

The great difference in the proportion of diameter to height between the Western Ghats form and the two other localities, in the first the two measurements being equal, denotes a very considerable modification of form, which may constitute, if constant, a very good variety.

In 'Contributions to Indian Malacology,' No. II., by Messrs. Blanford, they say "This shell is tolerably abundant on Banyan trees (*Ficus indica*) in the Botanical Gardens, Calcutta. We have also met with it in Orissa."

SITALA ATTEGIA, Bs. (Plate VIII. fig. 2.)

Helix attegia, Ann. & Mag. N. H. 1859, iii. p. 184; Pfr. Mon. Hel. vol. v. p. 91; Novit. pl. 78. f. 17, 18, 19; Conch. Ind. pl. lxxxv. f. 7, p. 36 (form of shell well given).

Sitala attegia, Th. Suppl. Cat. p. 20, = *culmen*, W. Blf.

Nanina (*Sitala*) *attegia*, Nev. Hand-list, p. 33.

Conulema attegia, Stoliczka, J. A. S. B. 1871, p. 237 (type of genus), pl. xviii. f. 1–4, = *culmen*, Blf.

Trochomorpha attegia, W. T. Blanford, Ann. & Mag. N. H., Feb. 1863.

Original description:—"*Testa anguste perforata, conica, tenui, striatula, liris tenuibus vix elevatis, remotiusculis, spiralibus, striisque minutissimis interpositis decussata* [Pl. VIII. fig. 2*a*], *pellucida, cornea; spira subanguste conica, sutura leviter impressa, apice acuto, pallido; anfractibus* 7 *convexiusculis, ultimo filoso-carinato, subtus convexiusculo; apertura vix obliqua, rhombeo-lunari, peristomate acuto, recto, margine columellari verticali, superne valde dilatato-reflexo, perforationem subtegente.*

"Diam. major 8, minor 7, axis 8 mill.

"Habitat ad Phie Than, vallis Tenasserim, frequens.

"Distinguished from the Cingalese *H. hyphasma*, Pfr., by its narrower conical form, sculpture, structure of columellar lip, &c."

Locality of specimen figured. Moulmain (*Stoliczka*).

Sculpture. On the upper whorls there are six distinct spiral ridges, the lowest being close to the suture; finer and intermediate ridges come in below, until on the last whorl they are numerous and rather close together, crossed by oblique regular striæ.

Size: major diam. 10·2 mm., alt. axis 7·5 mm.
„ 0·4 „ 0·3 inch.

Specimen from Prome, Pegu, figured Plate VIII. fig. 3.

Size: major diam. 11·0 mm., alt. axis 0·3 mm.

This species ranges from Ava (Blanford's coll.) through Pegu to Moulmain in Tenasserim.

Stoliczka (*l. c.* p. 237) thus describes the animal:—

"The animal is of a dull whitish colour; the larger warts of the body, often possessing a pink tinge, are arranged in oblique rows; the pedicles are grey, and this colour also extends over a part of the back; ridge of the posterior part of the foot ashy grey; mantle-lobes light, or sometimes pinkish grey; inner part of mantle, forming the pulmonary sac, with spots and stripes of dark pigment, giving the shell, when the animal is retracted, a spotted appearance.

"The mantle-lobes [Pl. VIII. fig. 2 *c*] are very slightly extensible; those covering the shell are somewhat thickened near their margins, the left shell-lobe being slightly reflected over the edge of the outer lip, so as to just cover it. The right dorsal lobe is much larger than the left, which is represented by a mere thickened rim.

"The general anatomy of the digestive and nervous organs and of the muscular system is exactly as in *Rotula.*

"The generative organs [fig. 2 *f*] have a large and long uterus; the terminal swollen end of the seminal receptacle is imbedded in a soft tissue at the anterior end of the prostata; vas deferens short and extremely thin, widened before it enters the penis, the expanded portion being filled with a granular colouring pigment, in which, however, no calcareous particles were discernible. The penis is rather thick, posteriorly prolonged and attached by thin muscles to near the end of the prostata. The amatorial gland [D] is a very strong, tough, twisted tube, enclosing a pointed flagellum. . . . .

"The jaw [fig. 2 *d*] is semicircular, slightly projecting in the centre of the concave edge, smooth, about the median part indistinctly and very finely concentrically striated . . . . . The radula [fig. 2 *e*] is very large, consisting of about 100, nearly straight or slightly undulating transverse rows. In a full-grown specimen I counted 405 teeth in a row, the formula being

$$200+2 \,.\, 1 \,.\, 2+200= \\ 202 \,.\, 1 \,.\, 202$$

and the total number of teeth about 40,000.

"The four median teeth are conspicuously larger than those following on either side; all have a sharp pointed cusp at the anterior end. The centre tooth has besides two smaller cusps at each side and is symmetrical; the following are gradually more and more turned on either the right or left side, and the smaller cusps are therefore developed only on one side; the last lateral tooth is styliform.

"The shell of *Conulema attegia* is subject to a large amount of variation. The original specimen described from Tenasserim was a thin horny shell, and probably not quite mature. Young shells have the periphery always very sharply carinated, and the spiral ribs or striæ on the whorls, as well as on the somewhat inflated base, are distinct. Specimens which live on foliage or other kind of vegetation on low land retain the thin horny structure of their shells, even when fullgrown; but the spiral striation of the whorls

is often difficult to be traced. On drier places and on sandstone hills the shells become more solid, and are covered with a thin horny cuticle; the spiral striation becomes very distinctly discernible, and there often appear intermediate striæ between the four or five stronger spiral ribs. A young specimen of this type has been described by Blanford as *Nanina culmen.* On limestone ground the shells become again more solid, often attaining a considerable thickness, and the specimens also grow to a larger size, but the spiral striation occasionally disappears almost entirely on the two last whorls.

"This species is common about Moulmain, though not so much on the low land as on limestone hills.

"The spiral angle of specimens collected in Burmah varies from nearly 70° to 86°. The following table will indicate some of the principal variations:—

	Pegu.		Moulmain.		
Number of whorls..	6	8	$6\frac{1}{2}$	$6\frac{1}{2}$	7
Larger diameter ..	5·8	13 mm.	7	8	11·2 mm.
Height of shell....	5·5	12 „	6·4	7·2	10 „
Spiral angle	72°	80°	70°	80°	86°
	culmen.	*attegia.*	*attegia.*"		

I have given this long extract from Stoliczka's interesting remarks on this shell because they show so well how the nature of soil, food, and moisture affects within very small areas the form and sculpture of the shells of these creatures; it is these slight changes, gradually becoming more permanent, to be extended over larger areas or remaining restricted, that are regarded as local races, or varieties, or subspecies, whichever the naturalist likes to call them, and which, after all, is quite immaterial to the general result of our observations. What we have to show is, how very unequal these areas are in size, and how they are distributed; and from this we shall find where the boundaries of these changes lie, and thence perhaps be able to connect them with the past and present distribution of land and sea.

SITALA CULMEN, W. Blf. (Plate VIII. fig. 4.)

Nanina culmen, Contrib. Ind. Mal., J. A.S.B. 1865, p. 72 (section *Trochomorpha*).

Conulema as =*attegia*, Bs., Stoliczka, J. A. S. B. 1871, p. 237.

Sitala as =*attegia*, Bs., Theob. Suppl. Cat. p. 20.

Nanina (*Sitala*) as=*infula*, Bs., Nev. Hand-l. p. 33.

Original description:—"Shell very minutely perforated, trochiform, very thin, horny, translucent. Spire conical, apex obtuse, suture impressed. Whorls 6, convex above, and ornamented with fine raised spiral lines and oblique striæ; the last whorl sharply keeled at the periphery, not descending, swollen and minutely decussately striated beneath. Aperture but little oblique, subquad-

rately lunate; height less than the breadth; peristome simple, thin; margins distant, columellar vertical, slightly reflected above."

"Major diam. 5·75, minor diam. 5·33, axis 5·5 mm.
,, 0·23, ,, 0·21, ,, 0·22 inch.

"Aperture 3 millim. broad, 2 high.

"*Habitat.* Akoutoung and banks of the Tsanda Khyoung, Henzadah district, Pegu.

"Easily distinguished from *N. confinis* and *N. attegia* by its smaller size and higher spire, from *N. arx* by the sides of the spire being straight and not concave, and from the Bengal *N. infula*, Bens., by its sculptrue and its sharper keel."

The shell figured is one of the two typical specimens (No. 65) in Mr. W. T. Blanford's collection. There are nine distinct spiral ribs, the two lowest close together, and these are in far stronger relief and more marked than in *infula*, and extend even to the base of the shell.

Size: major diam. 4·8 mm., alt. axis 6·3 mm.
,, 0·17 inch, ,, 0·25 inch.

For this form I retain the original specific name, as it seems to be a good and distinct local race, as nearly related by shell-character to *attegia* as it is to *infula*.

SITALA CONFINIS, W. Blf. (Plate X. fig. 2.)

Nanina confinis, J. A. S. B. 1865, p. 71 (section *Trochomorpha*); Pfr. Mon. Hel. vol. v. p. 83.

Helix confinis, Conch. Ind. p. 64, pl. clix. fig. 8 (not good).

Sitala confinis, Theob. Suppl. Cat. p. 20; Nev. Hand-l. 1878, p. 33.

Original description:—"Shell minutely perforated, trochiform, very thin, whitish horny, smooth, shining. Spire conical, apex slightly obtuse, suture scarcely impressed. Whorls 7, flatly convex, marked above with 4 or 5 spiral ribs and fine oblique lines of growth; the last sharply keeled, flatly convex beneath, and very finely radiately striated. Aperture oblique, subrhomboidal, twice as broad as high; peristome thin, acute, straight, margins distant, columellar subvertical, briefly and triangularly reflexed.

"Major diam. 10·5, minor diam. 9·5, axis 7·0 mm.
,, 0·42, ,, 0·38, ,, 0·28 inch.

"Aperture 5 mm. broad, 2·5 high.

"*Habitat.* Near Thayet Myo, on the borders of British Burma; also near Ava.

"A near ally of *N. arx*, Bens., from Tenasserim, which, however, may easily be recognized by the concave sides of its spire. From other related species (as *N. infula*, Bs., *N. cacuminifera*, Bs., and *N. attegia*, Bs.) *N. confinis* is distinguished by its sculpture."

The figure now given is from a specimen in Mr. W. T. Blanford's collection.

SITALA GROMATICA, n. sp. (Plate X. figs. 5, 5 *a*.)

Locality. Munipur Hills (*G.-A.*).

Shell pyramidal, sharply keeled, flat on base, scarcely perforate;

sculpture, 10 very fine spiral thread-like ribs far apart, with 4 close together at basal side of whorl near suture; colour pale ochraceous umber-brown; spire conic, sides nearly flat; suture shallow; whorls 7, sides slightly convex; aperture semilunate, subvertical; peristome thin, oblique on columellar margin and scarcely reflected.

Size: major diam. 3·4 mm., alt. axis 2·7 mm.
,, 0·13 inch, ,, 0·11 inch.

This species is at first sight very like *S. haroldi* of the Nicobars, but is distinguished by its more convex-sided whorls and higher spire, while it is not so flat on the base as *haroldi*, and has a much larger deeper aperture.

Sitala gromatica, var. (Plate X. figs. 6, 6 *a*.)

Locality. Khasi Hills (*G.-A.*).

Shell pyramidal, keeled, flat on base; sculpture, 12 to 14 distinct fine spiral ribs, crossed diagonally by irregular lines of growth, concentric ribbing on basal side; colour pale horny; spire conic, sides flat; suture shallow; whorls 6, slightly convex; aperture semilunar, narrow, oblique; peristome thin, perpendicular near axis, but becoming rapidly oblique.

Size: major diam. 0·12 inch, alt. axis 0·09 inch.
,, 3·0 mm. ,, 2·4 mm.

This shell only differs from the typical form in the greater number of the fine spiral ribs.

Plate X. fig. 8 is a young specimen from the Jatinga valley, North Cachar Hills, which was the first specimen detected in my collection when I began sorting some of the original boxes, and it thus was figured before the others.

Sitala haroldi, n. sp. (Plate X. figs. 7, 7 *a*.)

Locality. Andamans (11 specimens).

Shell pyramidal, imperforate; sculpture, on base distant concentric ribs in relief, above with 10 longitudinal or spiral white thread-like ribs of equal size and distance apart on each whorl (fig. 7 *a*); colour pale umber-brown; spire high, sides flat, apex acuminate; suture moderately impressed; whorls 7, sides flatly convex; aperture quadrate, slightly rounded below; peristome thin, columellar thickened above, straight oblique.

Size: major diam. 3·3 mm., alt. axis 2·7 mm.
,, 0·13 inch, ,, 0·11 inch.

This pretty species, remarkable for its very pyramidal form and flat base, was discovered by my brother Mr. Harold Godwin-Austen. I at first thought it must be *Helix* (*Sagdinella*) *microtrochus* of Mörch, described in Journ. Conchyl. Oct. 1876, p. 358, until I received the type specimen of *Sagdinella*, which shows the sculpture to be transverse and the shell in every way different from the group *Sitala* (*vide* Pl. IX. figs. 1, 1 *a*)*.

* This and the last described are close allies, but the form at once distinguishes the Andaman shell. The range of *gromatica* no doubt extends along the line of the Arakan Hills, which, there is little doubt, were once continuous with the Andaman Islands.

Sitala phulongensis, n. sp. (Plate X. fig. 4.)

Locality. East of the Kopili river, North Cachar (one specimen) (*G.-A.*).

Shell elongately pyramidal, scarcely perforate; sculpture, 6 to 7 well-raised longitudinal or spiral ribs on the whorls, fine close concentric ribbing on base; colour pale sienna-brown; spire high, sides slightly convex, apex blunt; suture well impressed; whorls $5\frac{1}{2}$, sides convex; aperture semicircular, oblique; peristome thin, columellar margin vertical, slightly reflected.

Size: major diam. 0·10 inch, alt. axis 0·09 inch.
,, 2·5 mm., ,, 2·3 mm.

I have more than twenty of this species, which is distinguished from its near allies by its more elongate form, rounder aperture, and the fewer and stronger liration. I have named it after the trigonometrical station of Phulong, near which it was first found by me, but it is very common at Cherra Poongee.

The shell figured is the single specimen from Phulong, and is not quite mature.

Sitala liricincta, Stol.

Conulema liricincta, J. A. S. B. 1871, p. 241, pl. xviii. f. 10.

Helix liricincta, Conch. Ind. p. 53, pl. cxxxii. fig. 7 (too dark in colour).

Sitala liricincta, Theob. Suppl. Cat. p. 20.

Nanina (*Sitala*) *liricincta*, Nev. Hand-list, p. 34 (type specimens).

Original description:—"Con. *testa late conica, tenui, castanea, apice pallido, vel omnino pallide lutescente, anguste umbilicato; anfractibus* 7, *convexe gradatis, sutura impressa simplici junctis, quatuor liris acutis spiralibus cinctis; liris duabus medianis crassissimis, superna tenuissima basi lævigata, prope peripheriam liris* 3–4 *tenuibus, approximatis notata; lineis incrementi subtilissimis et confertissimis; apertura subsemilunari, labio columellari rectiusculo, brevi, supra paulo reflexo; labro tenui, simplici, arcuato.*

"Major diam. 6·4, minor diam. 6·0, alt. testæ 5·8, alt. apert. 2·5, lat. apert. 3·0 mm.;" or major diam. 0·25, minor diam. 0·24, alt. testæ 0·23, alt. apert. 0·10, lat. apert. 0·12 unc.

"*Hab.* prope Moulmain, ad flumen Ataran.

"The species has the general form of a rather large and elevated *Con. palmaria*, Bs., but the spiral ribs are more distant and stronger, except at the periphery, which is less sharply carinated. I have not seen the animal; but, judging from the general resemblance of the shell to that of *infula*, it is tolerably certain that both belong to one and the same genus."

Sitala limata, n. sp. (Plate X. figs. 9, 9 *a*.)

Locality. Thamandaiva, Bassein, Pegu (*W. Blf.*).

Shell conoidal, scarcely perforate; sculpture, six thread-like longitudinal ribs on each whorl, close and spiral on base; colour horny brown; spire conic, apex blunt and rounded, sides slightly convex; suture impressed; whorls 5, sides convex; aperture broadly semi-

circular; peristome thin, columellar margin upright, rather thickened, a white callus on the body-whorl.

Size: major diam. 2·6 mm., alt. axis 1·6 mm.
,, 0·10 inch, ,, 0·06 inch.

SITALA CARINIFERA, Stoliczka.

Sitala carinifera, J. A. S. B. 1873, p. 16, pl. i. fig. 8.

Nanina (*Sitala*) *carinifera*, Nev. Hand-list, p. 33 (the type shell).

Original description :—" *Testa globose conoidea, cornea, apice obtusulo, angustissime perforato ; anfractibus quinque, gradatim accrescentibus, convexe angulatis, sutura simplici junctis, transversim minutissime striolatis, superis infra medium carinis filiformibus duobus ornatis, ultimo ad peripheriam tricarinato, basi planate convexiusculo, lævigato ; apertura semilunari, verticali, non descendente, labro extus tenuissimo, in regione columellari paululum reflexiusculo.*

" Diam. maj. 2·2 mm., minor 2·0, alt. testæ 2·0 mm.
,, 0·09 inch, ,, 0·08, ,, 0·08 inch.

" *Hab.* ' Penang Hill ' in foliis *Coffeæ arabicæ*, specimen unicum.

" The animal of this species is exactly like that of *S. infula*, figured in plate xviii. in J. A. S. B. vol. xl. (1871) ; it has a generally pale brownish-grey colour ; but having obtained a single specimen, I did not like to sacrifice the shell, in order to notice the internal structure ; for when examining these little species, one is by no means sure that he will obtain from a single specimen an insight into the whole anatomy.

" The present species is closely allied to the Nilghiri *H. tricarinata*, Blf., which is also a *Sitala*, and differs by a more depressed and broadly conical shape, and by having a much wider umbilicus."

SITALA PALMARIA, Benson. (Plate X. fig. 3.)

Helix palmaria, Ann. & Mag. N. H., Feb. 1864, p. 137; Pfr. Mon. Hel. vol. v. p. 575 ; Conch. Ind. p. 15, pl. xxx. f. 5, 6.

Sitala palmaria, Th. Suppl. Cat. p. 20.

Original description :—" *Testa perforata, subconica, spiraliter 7-lirata, striis filosis obliquis confertissimis decussata, sub epidermide cornea albida ; spira subconica, apice obtusiusculo lævigato, sutura impressa ; anfractibus* 6½, *convexis, ultimo subtus convexiusculo, peritremate leviter carinato ; apertura obliqua, late angulato-lunata, subsecuriformi ; peristomate tenui, recto, margine columellari superne breviter expansiusculo.*

" Diam. major 8½, minor 8, axis 6 mill.

" *Hab.* ad montem Nundydroog in regione Mysoriana.

" Two imperfect specimens were found by my son, Captain C. A. Benson, on the Fort Hill of Nundydroog, north of Bangalore, in Mysore, and a single specimen (fully grown, but weathered) by my daughter, Mrs. R. H. Sankey, at the same place, about 4000 feet above the level of the sea. It is very distinct from the various lirate species described by the Messrs. Blanford in the Journ. Asiat. Soc. Beng. for 1861, from the hill-ranges of Southern India."

The specimen figured is No. 66 of Mr. Blanford's collection and MS. list, a typical specimen from Benson, from the original locality. This measures—Major diam. 8·0, alt. axis 4·8 mm.

There are two other specimens in the same collection (No. 67) marked *palmaria*, var., from the Wynaad, collected by Colonel Beddome; these are much smaller, but in other respects similar, being only 5·0 mm. in major diameter.

Sitala arx, Benson. (Plate IX. fig. 8.)

Helix arx, Benson, Ann. & Mag. N. H. 1859, iii. p. 184; Pfr. Mon. Hel. v. p. 90; Conch. Ind. p. 25, pl. liv. fig. 8.

Sitala arx, Theob. Suppl. Cat. p. 20 (Therapon Hill, Tenasserim valley).

Nanina (*Sitala*) *arx*, Nev. Hand-list, p. 34.

Original description:—"*Testa anguste perforata, acute conica, tenui, striis minutissimis confertissimis obliquis, lirisque 3–4 spiralibus, validis, superne sculpta, subtus laviori, translucente, olivaceo-cornea; spira gracili, conica, lateribus concavis, sutura marginata, apice acutiusculo, hyalino; anfractibus $7\frac{1}{2}$, superioribus convexiusculis, tum planiusculis, ultimo acute carinato, subtus convexiusculo; apertura obliqua, trapeziformi, peristomate recto, acuto, margine columellari breviter reflexo, superne perforationem subtegente.*

"Diam. major 10, minor 9, axis $7\frac{1}{2}$ mill.

"*Hab.* ad collem Therabuin, vallis Tenasserim, nec raro; detexit W. Theobald."

"Distinguished by its sculpture and slender concave spire, which recalls that of my Nilgherry species, *H. cacuminifera*."

This last-named shell, however, is very distinct in its sculpture, and, together with other similar species from peninsular India and Ceylon, form a very distinct group by themselves, which I propose to figure together later on.

Figured from specimen in the Benson collection at Cambridge, in which there are five specimens labelled as from Tenasserim.

Major diam. 10·0, alt. axis 7·0 mm.

Sitala rimicola, Benson. (Plate IX. fig. 2.)

Helix rimicola, Benson, Ann. & Mag. N. H. 1859, iii. p. 266; Pfr. Mon. Hel. vol. v. p. 71; Conch. Ind. p. 28, pl. lxi. f. 1.

Macrochlamys rimicola (sec. D), Theob. Suppl. Cat. p. 19.

Original description:—"*Testa vix perforata, orbiculato-pyramidata, tenui, fragili, oblique striatula, diaphana, pallide cornea; spira conica, apice obtuso, sutura leviter impressa; anfractibus $5\frac{1}{2}$ convexiusculis, ultimo convexo, compresse rotundato; apertura obliqua, subquadrato-lunari, peristomate tenui, recto, margine columellari verticaliter descendente, basali arcuato.*

"Diam. major $4\frac{1}{2}$, minor 4, axis 4 mm.

"Var. *peripheria primo subangulata, angulo versus aperturam evanescente, in juniori magis conspicuo.*

"Habitat forma typica prope Landour Himalayæ occidentalis, varietas in valle Rungun prope Darjiling, rarissime."

"I got a single fresh specimen of this fragile species in October 1842, in a precipitous rift at the back of the Seinty or Queinty ridge, eastward of my grounds at Rockville, near Landour, and at an elevation of nearly 7000 feet. The Messrs. Blanford have lately procured the variety, but rarely, and in a dead state, in the Rungun valley in Sikkim, at an elevation of 4000 feet. From the data furnished by Mr. W. T. Blanford respecting the resort of species at Darjiling, I observe that the same forms evince a disposition to descend there to a lower altitude above the sea than in the western portion of the range—a circumstance attributable probably to the greater moisture of the climate,—whereas the drought and hot winds, which prevail for so many months in the year at the base of the western ranges, drive species to a greater height in order to obtain the humidity necessary to their existence. At Landour this form escaped the active researches of the late Dr. J. F. Bacon; and I am not aware of its having yet occurred to Capt. T. Hutton."

Locality of specimen figured. Nag-Tiba range, near Mussoorie, N.W. Himalaya.

Shell globosely trochiform; sculpture regular, distant longitudinal striation (furrows), crossed diagonally by sharply-defined close-set striæ, below regular and concentric; spire conoid, sides flat; whorls 6, sides moderately convex; aperture ovately lunate; peristome thin.

Sitala rimicola, var. (Plate IX. figs. 4, 4 *a*, 4 *b*, 4 *c*.)

Locality. North and west Khasi Hills (*G.-A.*).

Shell globosely conical; umbilicus hidden; sculpture, moderately strong, regular longitudinal striation or furrowing, with diagonal coarse ridges of growth; colour very pale horny brown; spire conical, sides slightly convex; suture fine; whorls 6, convex, the last tumid and rounded; aperture ovately lunate, oblique; peristome thin, columellar margin strong, reflected, perpendicular.

Size: major diam. 0·21 inch, alt. axis 0·16 inch.
,, 5·4 mm., ,, 4·1 mm.

Is a very abundant species in the above hills; the apex of the shell is much more acute than in examples from Mussoorie, and it is also larger.

Sitala rimicola, var., Benson. (Plate IX. figs. 3, 3 *a*.)

Locality. Darjiling, 4000 feet (*W. T. B.*).

Sculpture, very fine close longitudinal ribbing or furrowing, crossed by extremely fine diagonal regular striæ of growth, below rather coarser concentric ribbing, near umbilicus.

Size: major diam. 4·5, alt. axis 3·0 mm.
,, 0·18, ,, 0·12 inch.

Has flatter sides to spire and whorls, and is more depressed, with finer spire than typical *rimicola*.

Sitala injussa, W. T. & H. F. Blf. (Plate IX. figs. 5, 5 *a*, 5 *b*.)

Helix injussa, J. A. S. B. 1861, p. 356, pl. i. f. 13; Pfr. Mon. Hel. vol. v. p. 181.

Nanina (Microcystis) injussa, Nev. Hand-list, p. 38.

Original description:—"*Testa vix perforata, trochiformis, pertenuis, pallido-cornea, superne peroblique, infra radiatim striata; spira conica, apice acutiusculo; anfr. 5½, vix convexiusculi, ultimus non descendens, subtus tumidus, ad peripherium angulatus, angulo antice evanescente; apertura obliqua, transverse rotundato-lunaris; peristoma simplex, acutum, margine columellari subverticali, superne brevissime reflexo.*

"Diam. maj. 3·25 mm., min. 3 mm., alt. 3·25 mm.
,, 0·13 unc., ,, ·12 unc., ,, 0·13 unc.

"*Hab.* raro in Coonoor Ghat, montium Nilgiri.

"The Sikkim and Landour *H. rimicola*, Bens., is the nearest form to *H. injussa* with which we are acquainted. The Nilgiri shell has a higher spire, and is considerably smaller in size. From the comparatively large *H. infula*, Bens., *H. injussa* may be easily distinguished by the absence of the peculiar sculpture of that species, as well as by its fewer whorls and smaller size."

The specimen figured is in Mr. Blanford's collection and from original locality; there are two other specimens also from the Nilgiri Hills, No. 58 of his MS. list.

On the last whorl rather strong, spiral, parallel, somewhat wavy ridges are crossed by irregular lines of growth; on the apical whorls the transverse ridges are more regular and close together, giving an almost decussate appearance. The aperture is very oblique, and the peristome on outer margin sinuate above, so that the columellar margin is distinctly seen from the side. This specimen measures in major diam. 4·2, alt. axis 3·2 mm.

Sitala febrilis, W. T. & H. F. Blf.

Helix febrilis, J. A. S. B. 1861, p. 357, pl. ii. f. 4; Pfr. Mon. Hel. vol. v. p. 138; Conch. Ind. p. 52, pl. xxix. f. 4.

Macrochlamys febrilis (sec. E), Th. Suppl. Cat. p. 20.

Original description:—"*Testa angustissime perforata, globoso-turbinata, spiraliter lirata; spira subelevata, convexa, apice obtuso, suturis valde impressis; anfr. 4½, convexi, ultimus non descendens, ad perpheriam subdepressus infra planate rotundatus lævis; apertura obliqua, oblonga; peristoma rectum, acutum, ad basin expansiusculum, columellari breviter reflexo, marginibus remotis.*

"Diam. maj. 1·5, diam. minor 1·3, alt. 1·25 mm.

"*Hab.* apud montes Kalryenmullies, Ind. mer., teste R. Bruce Foote.

"This species bears a general resemblance to *H. tricarinata* above described, but is readily distinguishable by its higher spire, the absence of the characteristic triple carination, and the flatness of its basal surface. The two specimens received from Mr. Foote are both much weathered, and have lost their colour and much of the

sharpness of their ornament. This species I cannot find now in Mr. Blanford's collection. It was figured by Hanley, who only gives a view from behind."

SITALA TRICARINATA, W. T. & H. F. Blf. (Plate X. fig. 10, the type specimen also figured in the Conch. Indica.)

Helix tricarinata, J. A. S. B. 1861, p. 355, pl. i. f. 10; Pfr. Mon. Hel. vol. v. p. 91; Conch. Ind. p. 52, pl. cxxix. f. 7, 10.
Sitala tricarinata, Theob. Cat. Suppl. p. 20.
Nanina (Microcystis)? tricarinata, Nev. Hand-list, p. 42 (2 sp. ex coll. Blf.).

Original description:—"*Testa aperte perforata depresso-turbinata, tenuis, pallide cornea, oblique striatula, subtus obsolete decussata; spira conoidea, apice planulato, perobtuso, sutura impressa; anfr. 4, convexi, superne carinis duobus filiformibus cincti; ultimus tribus medianis, non descendens, subtus rotundatus; apertura subverticalis, rotundato-lunaris; peristoma rectum, acutum, marginibus distantibus, sinistro non reflexo.*
"Diam. $1\frac{2}{3}$, alt. 1 mm.
"*Hab.* prope Pykara ad summos montes Nilgiris."
Major diam. of specimen figured 1·4, alt. axis 1·0 mm.

SITALA SUBBILIRATA, G.-A. (Nev. MS.), n. sp. (Plate X. figs. 11, 11 *a*.)

Locality. Little Brother Andaman.

Shell depressly conoid, rather openly perforate, covered with a strong epidermis; sculpture, very fine longitudinal ribbing, well seen on base, crossed by irregular lines of growth; colour dull ochraceous brown; spire flatly conoid, apex flat; whorls 5, with a fine rib on the periphery of the last whorl, with a single intermediate one above it, sides flat from the suture to this, slightly convex above; aperture ovate, subvertical; peristome rather thickened; columellar margin slightly oblique, not reflected.

Size: major diam. 2·7 mm., alt. axis 1·3 mm.
,, 0·07 inch, ,, 0·05 inch.

SITALA SUBBILIRATA, var. (Plate X. fig. 12.)

Locality. Batte Malve.

This shell was sent me by Mr. Geoffrey Nevill from the Indian Museum, Calcutta, as No. 206. *Sagdinella didrichsenii*, Mörch, with a note attached, "I doubt it being this species." In this part, further on, I treat of this genus, which will clear up this uncertainty that surrounds Mörch's genus; and I now find that this shell from Batte Malve agrees well with Nevill's MS. *subbilirata* from Little Brother Andaman, only that the shell is not so well grown, and the apex is flatter, and I have therefore figured both.

It measures: major diam. 2·3 mm., alt. axis 1·3 mm.
,, 0·09 inch, ,, 0·05 inch.

No. 206 of Hand-list, p. 42, stands as "*Nanina* (*Microcystis*) *didrichsenii*, Mörch."

"Thirty specimens from Nicobar Islands, coll. Dr. F. Stoliczka," so that it is possible they may not be the same as the shell I figure from Batte Malve.

SITALA BILIRATA, W. T. Blf.

Helix bilirata, J. A. S. B. 1861, p. 352, pl. i. f. 7; Pfr. Mon. Hel. vol. v. p. 85; Conch. Ind. p. vii, not figured.

Kaliella bilirata (sec. B), Theob. Suppl. Cat. p. 20.

Nanina (*Sagdinella?*) (*Microcystis?*) *bilirata*, Nev. Hand-list, p. 41 (South India, ex coll. Dr. F. Stoliczka).

This species I have not found in Mr. W. T. Blanford's collection, so am unable to give a figure of it.

Original description:—"*Testa perforata, globosa, turbinata, solidiuscula, cornea, transverse striata; spira conoidea, apice obtusulo; anfr.* 7, *angusti, sensim accrescentes; superiores carina una supra mediana muniti, ultimus ad peripheriam acute bicarinatus, subtus tumidus; apertura subverticalis, angulato-lunaris, perist. rectum, marginibus distantibus, columellari brevi, verticali, reflexo.*

"Maj. diam. 6 mm., axis 4½ m.
,, 0·24 unc. ,, 0·18 unc.

"*Hab.* in montibus Shevroys et Nolamullies, teste W. King.

"This species apparently approaches the Ceylonese *H. mononema*, B., in character, but differs in its rounded base and less elevated spire."

SITALA ? TERTIANA, W. T. & H. F. Blf. (Plate IX. figs. 9, 9 *a*.)

Helix tertiana, J. A. S. B. 1861, p. 355, pl. i. fig. 11; Pfr. Mon. Hel. vol. v. p. 71; Conch. Ind. p. 8, pl. xvi.

Macrochlamys tertiana (sec. D), Theob. Cat. Suppl. p. 19.

Original description:—"*Testa perforata, depresse turbinata, tenuis, pallide cornea, striatula, spira conoidea, apice obtuso, sutura impressa; anfr.* 6, *angusti, convexi, ultimus haud descendens, subtus rotundatus; apertura subverticalis, rotundato-lunaris; peristoma simplex, marginibus distantibus, columellari reflexiusculo.*

"Diam. major 2·25 mm., alt. 1·75 mm.
,, 0·1 unc. ,, 0·07 unc.

"*Hab.* raro ad Pykara, necnon ad Neddiwuttom in montibus Nilgiris."

Specimen figured diam. major 2·5 mm., alt. 1·3 mm.

Messrs. Blanford add: "*H. bullula*, Hutt., and *H. humilis*, Hutt., of the Western Himalaya, together with some small Cingalese *Helices*, appear to belong to the same group."

It occurred at the edges of sholas, in company with *Jerdonia trochlea*, B., *Diplommatina nilgirica*, Blf., and *Cyathopoma malabaricum*, Blf.

I do not think *H. bullula* is allied to this species, for there is no sign of spiral striation on that shell; and *H. humilis* is, I suspect, a species of the subgenus *Patula*.

SITALA SRIMANI, n. sp. (Plate IX. fig. 7.)

Locality. Munipur (*G.-A.*).

Shell subdepressly turbinate, closely umbilicated; sculpture, with four or five indistinct longitudinal ribs, with rather coarse oblique lines of growth; colour ochraceous brown; spire depressed, apex blunt; suture well impressed; whorls 5, sides convex; aperture widely lunate; peristome rather thickened, columellar margin very oblique and scarcely reflected.

Size: major diam. 3·9 mm., alt. axis 2·2 mm.
„ 0·16 inch, „ 0·09 inch.

This shell is at first sight very similar to *S. tertiana*, but its close umbilication and different spire distinguish it.

I have named this species after and in remembrance of a Goorkha, Duffadar Sriman, who was in the Khasi-Hills Survey Party, and a most excellent trustworthy man, who, like so many others, fell a victim at last to the climate of that part of India. He became a most diligent collector; and to him I owe the possession of a large number of shells in my collection, which he even continued to collect after I had left the Survey Party. I have always noticed that the Goorkha, Lepcha, and Khasia made much more intelligent collectors than the people of the plains of India, that they took a far greater interest in the work, and poss[illegible] many of them a great amount of knowledge of animals and plants and their specific differences, while they recognize the numerous species, particularly the birds, by name.

SITALA MONONEMA, Benson. (Plate IX. fig. 6.)

Helix mononema, A. M. N. H. 1853, xii. p. 92; Pfr. Mon. Hel. vol. iv. p. 37; Reeve, Conch. Icon. f. 1339; Conch. Ind. p. 37, pl. lxxxvii. f. 2, 3.

Trochomorpha, Pfr. Malakoz. Bl. 1855, p. 132; Albers, Die Heliceen, 1860, p. 61.

Kaliella, sec. B, Theob. Cat. Suppl. p. 20.

Nanina (*Microcystis*) *mononema*, Nev. Hand-list, p. 41 (8 species, Balapiti, Ceylon).

Original description:—"*Testa angustissime perforata, trochiformi, radiato-striata, corneo-albida, glabra, non nitida, translucente, spira conoidea, apice obtuso, sutura distincta; anfractibus 6½–7, superne convexiusculis, filo unico, elevato, tenui, mediano cinctis, ultimo acute filoso-carinato, subtus subplanulato; apertura verticali, securiformi, peristomate recto, acuto, margine columellari brevi, verticali, reflexo, perforationem subtegente.*

"Diam. major 5, minor 4½, axis 4 mill.

"*Hab.* ad Heneratgodde, Ceylon." Mr. Benson says:—"Allied to the Himalayan *H. fastigiata*, Hutton, and to the Bengal *H. barrackporensis*, Pfr., but well distinguished by its more depressed form and by the filiform line, which, in addition to the keel on the last whorl, runs along the central part of each of the upper whorls. Mr. Layard had not been able to procure a second specimen." I do not agree with Mr. Benson as to the alliance or, I would rather say,

similarity between this species and the two above-named shells, the thread-like spiral midrib being so very distinctive of the subgenus I now place it in.

SITALA ? GRATULATOR, W. Blf. (Plate X. figs. 1, 1 *a*, 1 *b*.)

Nanina gratulator, J. A. S. B. 1865, p. 72 (section *Trochomorpha*); Pfr. Mon. Hel. vol. v. p. 94.

Helix gratulator, Conch. Ind. p. 8, pl. xvi. fig. 2.

Sitala gratulator, Theob. Suppl. Cat. p. 20; Nev. Hand-list, 1878, p. 33.

Original description :—"Shell turbinate, perforated, thin, whitish horny. Spire conical; apex obtuse; suture impressed. Whorls 5, slowly and regularly increasing, convex, spirally lirate and marked with oblique striæ of growth above; the last whorl keeled at the periphery, convex and decussately marked with concentric and radiating striæ below, not excavated round the perforation. Aperture diagonal, subtrapezoidal, breadth exceeding the height; peristome thin; margins distant, united by a callus, basal deeply sinuate; columellar vertical, forming a right angle with the basal, and briefly triangularly reflexed above; reflexed portion thickened and passing half round the perforation.

"Major diam. 5·0 mm., minor diam. 4·5 mm., axis 4·0 mm.
,, 0·2 ,, 0·18 ,, 0·16 inch.

"Aperture 3 mm. broad, 2 high.

"Animal with a small mucous pore, and very small lobe above.

"*Hab.* Irawaddy valley, Pegu.

"This pretty little species abounds near Thayetmyo, and occurs throughout the Irawaddy valley in British Burmah. I do not remember meeting with it in Arakan. It is easily distinguished from all others of similar form among Indian shells by its oblique mouth, by the peculiar columellar margin of the peristome, and by the strong lirate sculpture. I have much doubt as to whether it should be assigned to *Trochomorpha*, the species of which group are larger and the animals somewhat different."

This species does not occur, to my knowledge, anywhere on the Indian side in Assam.

The subgenus *Sitala* can be divided into the following very distinct groups :—

Character.	Name.	Locality.
A. Shell small, pyramidal, closely umbilicated, keeled, more or less flat below, with four or more spiral ribs on the whorls; columellar margin simple, more or less oblique; spire with flat sides; apex acuminate	*infula*	Lower Bengal.
	attegia	Tenasserim.
	culmen	Pegu.
	confinis	,,
	haroldi	Andamans.
	gromatica	Munipur.
	phulongensis	North Kachar Hills.
	liricincta	Tenasserim.

Character.	Name.	Locality.
a′. Shell conoid, apex blunt	*limata*	Pegu.
a″. Shell conoid, depressed, sides convex	*carinifera*	Penang.
	palmaria	Mysore.
a‴. Spire high, with concave sides	*arx*	Tenasserim.
B. Shell globose; whorls tumid, with many fine, close-set, longitudinal ribs	*rimicola*	N.W. Himalaya.
	——, var.	Darjiling.
	——, var.	Khasi.
b′. Sides convex; spiral ribbing less regular	*injussa*	Nilghiri Hills.
b″. Globosely turbinate, very small	*febrilis*	Kalryenmulli Hills.

The following species are very distinct forms, and one is tempted to place the first two in a new subgenus:—

Character.	Name.	Locality.
C. Shell depressly conoid; whorls turreted, with one or two spiral ribs; apex flat	*tricarinata*	Nilghiri Hills.
c′. Openly umbilicated	*subbilirata*	Little Brother Andaman Island.
	——, var.	Batte Malve Island.
c″. Apex obtuse	*bilirata*	Shevroy and Kolanully Hills.
c‴. Longitudinal ribbing indistinct, umbilicated	*tertiana*	Nilghiri Hills.
	srimani	Munipur.
	mononema	Ceylon.

The next is distinct from all the preceding species, and the animal, no doubt, will be found presenting differences:—

Character.	Name.	Locality.
D. Shell conoid, rounded below; aperture very oblique; spiral ribbing both above and below; columellar margin thickened, perpendicular, and twisted	? *gratulator*	Pegu.

These are quite distinct, in their sculpture particularly, and will be figured together in a future Part:—

Character.	Name.	Locality.
E. Apex acuminate, spire more or less concave; transverse ribbing more regular and defined, a spiral sulcation breaking up the former into minute raised dots or dashes, having a longitudinal arrangement	*apicata*	Nilghiri Hills.
	cacuminifera	"
	concavospira	Ceylon.
	conulus	"
	emiliana	"
	hyphasma	"
	layardi	"
	phideas	"
	phyllophila	"
	verrucula	"

EXPLANATION OF PLATE VIII.

Fig. 1. *Sitala infula*, Benson, × 4. Calcutta.
1 *a*. Ditto: sculpture of last whorl, × 180. 1 *b*. Sculpture of the apical whorls, × 180.
1 *c*. Ditto: animal, × 2. From drawing by F. Stoliczka.
1 *d*. Ditto: jaw, enlarged. From drawing by F. Stoliczka.
1 *e*. Ditto: teeth of radula. From drawing by F. Stoliczka.
1 *f*. Ditto: generative organs, much magnified. 1 *g*. Showing enlargement of oviduct (*a*). From drawing by F. Stoliczka.
2. *Sitala attegia*, Bs., × 4. From Moulmain.
2 *a*. Ditto: sculpture of apical whorls, × 180. 2 *b*. Sculpture of the last whorl, × 180.
2 *c*. Ditto: right and left shell and dorsal lobes of the mantle, enlarged. From drawing by F. Stoliczka.
2 *d*. Ditto: jaw. From drawing by F. Stoliczka.
2 *e*. Ditto: teeth of radula.
2 *f*. Ditto: generative organs, much enlarged.
3. *Sitala attegia*, Bs., × 4. Prome, Pegu.
4. —— *culmen*. W. Blf., × 4. Pegu.

EXPLANATION OF PLATE IX.

Fig. 1, 1 *a*. *Sagdinella didrichsenii*, Mörch, × 7. Nicobar.
2. *Sitala rimicola*, Bs., × 7. Mussoorie, N.W. Himalaya.
2 *a*. Ditto: sculpture of last whorl, × 50.
3. *Sitala rimicola*, var., Bs., × 7. Darjiling, E. Himalaya.
3 *a*. Ditto: sculpture, × 50.
4, 4 *a*. *Sitala rimicola*, var., × 7. Khasi Hills.
4 *b*. Ditto, × 4, viewed from below. 4 *c*. Ditto, nat. size.
5, 5 *a*. *Sitala injussa*, W. & H. Blf., × 7. Nilghiri Hills.
5 *b*. Ditto: sculpture, × 50.
6. *Sitala mononema*, Bs., × 4. Ceylon.
7. —— *srimani* (G.-A.), × 7. Munipur.
8. —— *arx*, Bs., × 4. Tenasserim.
9, 9 *a*. —— ? *tertiana*, W. & H. Blf., × 12. Nilghiri Hills.

EXPLANATION OF PLATE X.

Fig. 1. *Sitala gratulator*, W. Blf., × 4. Thayetmyo, Pegu.
1 *a*, 1 *b*. Ditto, showing form of the columellar margin, × 7.
2. *Sitala confinis*, W. Blf., × 4. Thayetmyo, Pegu.
3. —— *palmaria*, Bs., × 4. Mysore.
4. —— *phulongensis*, G.-A., × 7. N. Cachar.
5. —— *gromatica*, G.-A., × 7. Munipur.
5 *a*. Ditto: sculpture, × 50.
6. *Sitala gromatica*, var., × 7. 6 *a*. Sculpture. Khasi.
7. —— *haroldi*, G.-A., × 7. 7 *a*. Sculpture, × 50. Andamans.
8. —— *gromatica*, juv., × 7. North Cachar Hills.
9. —— *limata*, × 12. 9 *a*, × 8. Pegu.
10. —— *tricarinata*, W. & H. Blf., × 20. Nilghiri Hills.
11, 11 *a*. —— *subbilirata*, G.-A., Nev. MS., × 12. Little Brother Andaman.
12. Ditto, var., × 12. Batte Malve Island, Nicobars.

Subgenus Sagdinella.

The genus *Sagdinella* of O. A. L. Mörch was introduced, but without description, in Journ. de Conch. Oct. 1872, in his list of "Mollusques terrestres et fluviatiles des Iles Nicobar," the type form being *didrichsenii* from Sambelong in that island. He compares it with

simulans, Adams, a Jamaica form, which is not likely to be related, and he would class with it *orcula*, Bs., *barrakporensis*, Pfr., and *infula*, Bs., of the East-Indian region. The two last could hardly be classed together on shell-characters, and a genus has already been formed for *barrakporensis*. In the Journ. de Conch. Oct. 1876, p. 357, in a revision of the Land Shells of the Nicobars, another species is added, viz. *H. microtrochus*, Mörch, found with the former. He thinks *Sagdinella* may be allied to *Streptaxis* in its sculpture (transverse); but this would hardly be a sufficient reason on which to form such an alliance, unless combined with other characters.

Mr. G. Nevill, in his 'Hand-list of the Mollusca in the Indian Museum, Calcutta,' p. 35, includes both *Sagdinella* and *Kaliella* under the subgenus *Microcystis*, Beck (type *ornatella*, Beck, from Pitcairn Island, a South-Pacific shell); and in this he has placed most of the minute Indian species, many with most varied characters. Knowing that I was engaged working upon these small shells he was good enough to send me a specimen named *didrichsenii*, from Batte Malve; but as it did not agree with the original description, I applied to the Zoological Museum of the University of Copenhagen for specimens of the shell. Professor Japetus S. Steenstrup responded most cordially to my request and kindly sent me a specimen in the Museum, the label in Mörch's handwriting—"*Sagdinella* (*Hapalus*?) *didrichsenii*, Roepst. 1877, p. 370. Nicobar." The original specimen described in 1872 was collected during the voyage of the 'Galathea' by M. Reinhardt, and should be in the Museum at Copenhagen, where most of his shells were placed. The Museum of Kiel received those of M. Behn; and Cuming obtained duplicates of this last collection described by Pfeiffer, Frauenfeld, &c. I have thus been able to figure a typical shell of this genus and clear up all uncertainty about it, for which I and other conchologists owe our thanks to Prof. Steenstrup. It certainly has no relationship to either *Sitala* or *Kaliella* in any way; moreover I do not think it is quite mature, and it possesses, as Mörch says, some similarity in its transverse costulation to that of *Streptaxis*. I here give the original description of the shell; the animal is quite unknown; but whatever it may be, it undoubtedly belongs to a group quite distinct to those with which Nevill associated it.

HELIX? (SAGDINELLA) DIDRICHSENII. (Plate IX. figs. 1, 1 *a*.)

Journ. Conch. Oct. 1872, p. 312.

Var. *β. grandis*, Journ. Conch. Oct. 1876, p. 358.

Nanina (*Microcystis*), Nev. Hand-list, p. 42. no. 206 (30 sp. Nicobar, ex coll. Dr. F. Stoliczka).

Original description:—"*Testa turbinata, perforate umbilicata, crystallina albida nitida, leviter iridescens; anfr.* 3½ *convexiusculi, costulato-striati, ultimus magnus, spiram fere duplo superans, medio obsolete angulatus; basi lævissima; apertura subrhombea.*

"Diam. maj. 2½ mill., axis 2 mill., aperturæ altit. 1½ mill.

"*Hab.* Sambelong, sur les bords de la rivière Galathea; un seul exemplaire.

" *Obs.* L'*Helix simulans*, Adams (Reeve, Icon. f. 351), donne une assez bonne idée de cette espèce.

" L'*H. orcula*, Benson (Reeve, f. 1176), en diffère par sa spire beaucoup plus élevée. L'*H. barakporensis*, Pfr. (Reeve, f. 816), et l'*H. infula*, Benson (Reeve, f. 783), de l'Hindoustan, appartiennent peut-être à la même section. La coloration et le genre de costulation de la coquille rappellent les *Streptaxis*. Peut-être est-ce un *Agnathe*?"

H. orcula is the only shell above mentioned that approaches it in its sculpture, but it has a strong epidermis. I am sorry that the two specimens in Mr. W. T. Blanford's collection are not quite perfect, and not in a state to take off the glass slide on which they are gummed, so that I cannot give an enlarged figure of it.

" Var. *β. grandis*, alt. 3·5 mill., diam. 3. *T. tenuis*, non iridescens linea alba, pellucente, ad suturam.

" *Hab.* Iles Nicobar, probablement Kamorta (*Roepstorf*).

HELIX (SAGDINELLA) MICROTROCHUS, Mörch, Journ. Conch. Oct. 1876, p. 358.

" *Differt a præcedente testa obtuse angulata, obtecte perforata, nec umbilicata, columella recta ; linea suturali, alba pellucente.*

" Alt. 3·5 mill., diam. fere 3.

" *Hab.* Avec l'espèce précédente: un exemplaire (*Roepstorf*). Les *Sagdinella* doivent être rangés, peut-être, près des *Streptaxis*, d'après leur sculpture: quant à la forme, elles ressemblent à de jeunes *Bulimus* (*Ena*)."

Professor Steenstrup informs me this species is not in the museum at Copenhagen, nor could he find it in the collection of a friend of the late Dr. O. Mörch; being a single specimen, it may be in Mr. Roepstorf's collection.

Genus ANADENUS.

(Plates VI. & VII.)

The genus *Anadenus* was described by Von F. D. Heynemann in the 'Malakozoologische Blätter,' 1863, p. 137, pl. i., giving figures of the shell of two species with their lingual dentition. The specimens were collected and brought home by the Schlagintweits from India, and the original description is therefore from spirit-specimens as follows:—

" *Anadenus* (without a tail-gland).

" Body extends the whole length of the sole. Mantle covering the fore part of the body. Respiratory orifice behind the middle of the right side of the mantle. Generative orifice behind the right eye-tentacle. Two upper and two lower retractile tentacles. Back flatly rounded, without a keel and without a tail-gland. Sole in three parts. The jaw with close-set cross ribbing; the curve of the teeth of the radula almost in a plane. Tooth-plates of rectangular form, with the sides projecting. Middle tooth equilateral, with side points or prickles. Side teeth hardly differing from the middle

tooth, with the small points on the exterior side. Internal shell present, white, calcareous, with no epidermis; nucleus on the side.

"Animal at first sight is like our German *Arion* and *Limax*. It is related to *Arion*, to *Limax* only similar.

"The relationship to *Arion* is in the form of the jaw, which has ribs like that of *A. empiricorum*, but they differ in the following points :—

Arion.	*Anadenus.*
Tail-gland present.	absent.
Respiratory opening anterior to middle of mantle.	close behind.
Internal shell, absent.	present.
The mantle contains only scattered calcareous particles.	with distinct lines of growth.

"The absence of the tail-gland is the principal difference between *Arion* and *Anadenus*; less importance must be placed on the position of the lung-opening. In dead *Anadenus* it is in the middle; but the front part of the mantle always contracts more than the hinder part. In *Limax* it lies behind the middle, but in a spirit-specimen it is in the middle.

"The new species is nearest to *Geomalacus* of Great Britain, which I have not had an opportunity of examining, and from which it differs in the following points :—

Geomalacus.	*Anadenus.*
End of the body rounded.	pointed.
Respiratory orifice in the middle of the side of the mantle.	behind the middle.
Tail-gland present.	absent.

"It must not be confounded with *Limax*, although it is similar in general form, in the position of the respiratory and the genital apertures, and in the presence of the inner shell; besides they differ in the jaw and in the terminal end of the body, which in *Limax* is always keeled, whereas in *Anadenus* there is no sign of a keel.

"If we could see the living animals or get an accurate description of them, undoubtedly further differences between similar or related forms would be shown, and in one respect from the formation of the wrinkles of the mantle and the body. As I observed before, in the dead animal the wavy circles on the mantle disappear. It cannot be said whether the mantle of *Anadenus* is papillate, as in *Arion*, *Amalia*, and *Geomalacus*, or whether it has the structure of *Limax*. Similarly the wrinkles on the back flatten out, and no accurate description can be made from a spirit-specimen.

"From the illustration which I give [reproduced, Pl. VII. fig. 4] of the skin of the back it is clear that it differs considerably from all known slugs. A furrow runs along the middle of the back, from which side-furrows branch off at an acute angle the spaces en-

closed by these furrows are covered with a double row of irregular diverging wrinkles."

Anadenus giganteus (type species).

From original description. Length of spirit-specimen 80 to 100 mm.
,, the mantle 30 to 40 ,,

Colour isabelline, brownish.

Internal shell 20 mill. long, 12 broad; flat, very thick. Jaw with fourteen ribs, distinct from each other; the last are grown together.

Radula: 110 cross rows; the middle tooth slender, long-necked, with long point and signs of side points; the side teeth not differing much, inclining inward, with still longer points, and likewise signs of side points, and in the less developed teeth towards the edge the points are still much longer with no side points. The upright position of the points (*vide* orig. fig. 1 *d, e, f*), and which is most prominent in the side teeth, is also peculiar to *Arion*. From the size of the contracted median and from the circumference of the inner shell and the size of the teeth-plates we can conclude with some certainty that this species is of extraordinary length. *Limax doriæ* of Bourguignat, who says it is 360 to 450 mm. long (or 13 to 17 inches), has hardly from the plate (in Revue et Mag. pl. viii. June 1861) so large a shell. I do not maintain that this extraordinary length could be reached in *giganteus*. Equally interesting may it be in a living state from its bright colour, which certainly does not differ much in the spirit-specimen.

Hab. Fundort Shimpti (Shipki?), Kumaon; Badrinath to Masuri, Garhval.

Anadenus altivagus, Theobald. (Plate VI. fig. 1, spirit-specimen.)

Limax altivagus, J. A. S. B. 1862, p. 489.

Anadenus giganteus, Heynemann, Malakoz. Bl. 1863, p. 140, t. i. f. 1; Theob. Suppl. Cat. C. i. p. 65; G. Nevill, Second Yarkand Mission, Mollusca, p. 21.

Anadenus? giganteus, Nevill, Hand-list, p. 65 (Changligalli, near Murree).

Original description:—"*Corpore limaciformi, pallio lente granuloso, dorso rugose reticulato, more frondis brassicæ, colore virescente fusco sive lutescente fulvo, interdum nigrescente, et rarissime pallide aurantiaco pallio, minus colorato corpore; tentaculis quatuor nigris, capite nigro, infra pallescente; ano ad dextrum latus pallii, prope marginem posito, ad medium partem vix attingente.*

"Longitudinis (corpore extenso) 9 unc.

"Habitat montibus Cissutlejensibus prope Fagu, Narkanda, Saraon, &c., 6000 ad 9000.

"This *Limax* is rather variable in colour, and large specimens, when in motion and extended, exceed 9 inches in length, though their ordinary dimensions is about 6. It feeds on fungi."

This species is evidently the same as that described by F. D. Heynemann in 1863 under the title *giganteus* and the type of his genus *Anadenus*. The length of specimens contracted in spirit

being 80–100 millims., as given by Heynemann, would be quite 6 to 9 inches when living, and extended to their full length. The description as regards texture of the epidermis of the mantle and foot agrees well; and they are both from the same part of the Western Himalayas—Heynemann's specimens having been collected by one of the brothers Schlagintweit in Shimpti (Shipki?), ? Kumaon, Badrinath to Masuri, Garhval. There is a single unnamed specimen in the British Museum collected by the above gentlemen, but it is labelled "Sikkim Himalaya," which I take to be this species; and this is no doubt a duplicate specimen sent originally to the Hon. E. I. Co.'s Museum, whence it was lately transferred, with the rest of the collection, to the British Museum: 75 mm. long, mantle 30. Six specimens were sent to me labelled "Simla, collected in the rainy season of 1880," by some friend, who I have yet to discover, but to whom my best thanks are due, for it is from these specimens the drawings on Plate VI. have been made. They agree in every way with Theobald's description of *altivagus*, and with the British-Museum specimen above mentioned. Heynemann does not give Sikkim as the habitat of *giganteus*, though he makes *schlagintweiti* common to both that and the Western Himalaya. There may be some error here in the labelling of the specimens.

ANADENUS ALTIVAGUS, Theob.

External description of animal (from spirit-specimen) collected at Simla (*vide* fig. 1, Plate VI.).—Slug-like, rounded above; foot rather pointed behind; no gland, with a narrow segmented pedal margin. Mantle closely fitted to the foot behind, only slightly overlapping on the sides; the neck-lobes only partially developed near the respiratory orifice, with a fine papillate surface. The respiratory and anal orifices (figs. 2 & 3) situated together just above the centre of the mantle-margin. The generative orifice (fig. 4) at a moderate distance (about 8 or 10 mm.) behind the right eye-tentacle.

Total length	70·0,	mantle length	30·0,	mantle breadth	20·0 mm.
,,	2·75	,,	1·20,	,,	0·8 inch.

Largest spec.: Shell quadrate, flat, thin, horny, white, with concentric lines of growth, nucleus on right central margin.

Major diam.	15·0 mm.,	minor	10·0 mm.
,,	0·60 inch,	,,	0·4 inch.

Odontophore, &c. The jaw is solid and composed of 13 ribs (Pl. VI. fig. 5). In the radula (figs. 6, 6 *a*) the centre tooth is broad, with two small pointed projections at the base; the adjacent laterals are also broad, with a single small blunt tooth on the exterior side; about the 28th from the centre they become much more elongated, and the outer basal tooth is rather sharper. The outermost laterals are oblong at the base, with one long blunt tooth and one or two small teeth disunited and separate from it, but rising from the same base (figs. 6 *a*, 6 *b*). These outer teeth are very characteristic of the

genus, for nothing like them is to be found in either *Arion* or *Limax*. The teeth of this species do not certainly agree with the radula described and figured by Heynemann; there is a similarity only so far as the straight form of the central teeth; but he distinctly says all the laterals are straight and with no basal cusp, and he thus figures the 55th of *giganteus* (Taf. i. fig. 1 *f*); and the 40th tooth of *A. schlagintweiti* has this small basal tooth, but he adds that on the extreme laterals it disappears. There were 106 rows in a very complete radula I got out, arranged thus:—

55 . 1 . 55.

The jaw and radula are found to be like that of *Geomalacus*, to which genus *Anadenus* has, in this respect, some affinity (*vide* Plate XII. figs. 4, 4 *a*, 4 *b*).

Generative organs (Plate VI. fig. 7). The ovotestis (*o.t*) is bilobed, and situated quite within the folds of the liver-lobes, and is of a pale green tint; the hermaphrodite-duct is rather long, a good deal convoluted near its lower end, but is straight for a short distance before it joins the albumen-gland; this organ is very large, and lies on the left anterior side of the animal. The oviduct is of the usual form. The vas deferens (*v.d*) is given off just above the duct of the spermatheca; it is very long, and is coiled on itself at one point about the middle of its length; this coil lies well forward on the left anterior side behind the left tentacle, and doubles back on itself, and passing up the side of the male organ enters it at the hard rounded posterior end, close to where the retractor muscle is given off. The attachment of this muscle is at the posterior margin of the mantle-cavity; it is so much contracted in the spirit-specimen as to bring the posterior end of the penis close up to it and the attachments of the eye-tentacles, &c. The spermatheca (*Sp*) is about the same length as the penis, pear-shaped.

All the six specimens sent to me from Simla (where they were collected during the rains in June and July, at the period when they are in full activity and development) show the generative orifice much expanded, with the male organ partly protruding (Plate VI. figs. 1 & 4). This discloses the existence of several small, sharp, curved spines fixed upon the surface of this reversed portion. On further opening the generative orifice (Plate VII. fig. 6), these curved spines were discovered to be only the most advanced of a much greater number arranged in two parallel rows (*d*) and extending upwards, gradually lengthening, and forming part of a very complicated and beautiful arrangement of far longer and stronger calcareous (*c*) spines. The frontal side of this curious apparatus was found covered by a large and longitudinally perforated plate (*a*), which had evidently been built up by the union together at their upper and lower extremities of originally parallel spines. On the posterior side of this basal portion of the male organ one very large, long, spear-shaped spine (*e*) was situated; this measured 8 mm. in length. The whole of this complicated structure must therefore be regarded as representing the simple dart-sac with a single dart,

as seen in other genera of the Helicidæ, for the fixed position of the bases of these spines in the integument of the lower swollen portion of the male organ precludes the idea of its being a spermatophore. On following the large duct of the penis upwards towards the junction with it of the vas deferens (fig. 6 *a*), the end of the penis is seen, occupying the upper swollen portion; so that here we have apparently the penis and the dart-sac almost united together, instead of, as is usual, the dart contained in a distinct and long sac of its own; but this, after all, is only a question of degree, for the transition is seen in such rudimentary pouches of the dart in *Helix pisana* (vide pl. xix. fig. 16, Moquin-Tandon's 'Mollusques de France,' and *Helix bulimoides*, pl. xx.).

Can it be that in this species the great development of spines and this plate has converted this organ into one of a holding or clipping nature on their interlocking or entanglement prior to or during the act of copulation? for after expansion or protrusion the muscular contraction would draw these spines together very tightly.

One of the most interesting points in the anatomy of this species is the relative position of the heart and renal organ (Plate VII. fig. 5), in which respect it has a considerable similarity to what is seen in *Arion* and *Geomalacus*, encircling the heart. The position of the ventricle is, however, different, on the posterior edge of the mantle-cavity and directed backwards; it is large and flatly pear-shaped.

The renal organ is ovate and is divided into two portions by a main secretory duct, the inner portion forming a nearly complete narrow disk round the ventricle and commencing from near where the aorta is given off. The renal organ is quite free for three quarters of its anterior margin, the dorsal surface (which is underneath in fig. 5) being spread over with the network of the pulmonary veins, the ventral surface of the pulmonary sac being shown in the figure. The retractor muscles of the eye-tentacles, odontophore, and penis (*r.m. T.*, *O.*, *P.*) are all situated in a line close together at the posterior margin of the mantle; and in this they are thus somewhat more like *Arion*, only that the muscle of the buccal mass has a more posterior position for its attachment.

ANADENUS SCHLAGINTWEITI, Heynemann, Malakoz. Blät. 1863, p. 141.

Anadenus schlagintweiti, Theob. Cat. C. i. p. 65.

This species would appear to be externally very similar to *A. altivagus*, or the typical species of Heynemann, but smaller. There are two specimens in the British Museum which may probably be this species, and out of the Schlagintweit collection. They are both of a dark grey colour and smaller than *altivagus*. One is marked "Bias at Bishisht, Kulu Himalaya;" the second "On road from Simla to Sultanpur, Himalaya." Heynemann gives, besides these two places, Bias Kund, Rotang Pass, and Sikkim; but I doubt the Sikkim locality.

Original description :—" Length of spirit-specimen 45 to 60 mm.
" Length of the mantle 25 mm.
" Colour ash-grey or blackish.
" Internal shell 11 mm. long, $7\frac{1}{2}$ broad, massive, thick, flat.
" Jaw with 16 ribs.
" Radula 125 rows of 90 teeth.
,, 110 ,, 80 ,,

" Middle tooth broadly triangular, with moderately long points; the side points are somewhat broader at the base; side teeth hardly differ from the middle tooth, inclined inwards. The shape does not perceivably change even towards the side, only at last the side point disappears.

"*The young animal.* On the back part of the mantle is a black spot, which runs in a point in front and encloses a small space, which is brighter than the rest of the mantle. The sides of the mantle are black-spotted, and down the sides of the body runs a black stripe, which towards the back is sharply marked out, but towards the sole is shaded off; the top of the back is again somewhat darker.

" It is very probable that, as in the case of many European slugs which in their young state are similarly coloured, this coloration disappears through the darkening of the whole skin.

"*Habitat.* Sikkim; Simla to Sultanpur; Bias at Bishisht, Kulu; Bias Kund, Rotang Pass.

" As these two forms were obtained from different localities, we may consider the species to be generally distributed and common; according to Schlagintweit it exists at 13,420 feet. In all probability their food is fungi."

Anadenus jerdoni, n. sp. (Plate VII. fig. 7, spirit-specimen.)

Kashmir (*T. C. Jerdon*). In coll. Brit. Mus.

Description from spirit-specimen. Animal large. The mantle apparently finely papillate in life. The foot above very coarsely wrinkled, rounded at extremity. No gland. A very narrow pedal margin. The respiratory orifice at the posterior right margin or about one third the length of the mantle from the posterior side. The eye-tentacles would appear to be very large at the base. The mantle, viewed from above, is rather circular in form. The foot has a wide central area.

Total length 101·6, mantle 38·0, breadth 31·8 mm.
,, ,, 4 ,, 1·5 ,, 1·25 inch.

Jaw is well ribbed, and 0·2 inch or 5·1 mm. wide.

There is only one specimen at the British Museum, and therefore I am unable to give any details of the anatomy of this species, of which no doubt some will be found in the Indian-Museum collection, Calcutta. The gigantic specimens alluded to by Mr. G. Nevill, in the molluscan portion of the 'Scientific Results of the Second Yarkand Mission,' under *Anad. altivagus*, I well remember his showing me in Calcutta. They are certainly very distinct from the Simla specimens I have seen, and much nearer *A. jerdoni* in outward

appearance. Heynemann's name would have well suited these gigantic Nepalese slugs; but his description certainly applies to a much smoother animal, so well shown in his figure of a portion of the foot viewed from above (plate i. fig. 1 *h*), and which I reproduce on Plate VII. fig. 4. The Nepalese species I propose to distinguish by the name *insignis*.

The shells described by Mr. Nevill in the above work were collected by Dr. F. Stoliczka; and from his notes it would appear that he distinguished two other species as occurring at Changligalli, near Murree, both of small size, like *modestus*. Nevill thus refers to them:—

"*Anadenus*, sp.—I should not have ventured on separating this single specimen, found with the two preceding, but for a note of Dr. Stoliczka's, which says, 'I also found near here four specimens of an *Arion* and specimens of two other *Arion*-like slugs.' It is slightly larger than the preceding, and of a black instead of a light liver-colour; otherwise I can see no difference."

"*Anadenus*, sp.—Described by Stoliczka in his notes as 'a slug like the one I found at Changligalli, but with the foot sharply crested.' Where this was found is not recorded, and it might possibly be another genus, from the keeled foot."

ANADENUS BLANFORDI, n. sp.

From the single spirit-specimen it would appear to have been of a dark ochraceous brown, with some dark grey mottlings on the upper part of the foot. It may be distinguished by the very different arrangement of the warty protuberances on the epidermis, these being well raised, isolated, and elongately diamond-shaped.

Total length 44, length of mantle 16, breadth 11 mm.
,, ,, 1·75 ,, ,, 0·65 ,, 0·45 inch.

Hab. Darjiling, about 7000 feet (*W. T. Blanford*).

There is no doubt of its distinctness from all other species I have seen, but I defer figuring it until I receive a large collection in spirit now on its way from Sikkim. The single specimen described was given me by Mr. W. T. Blanford, together with several other interesting shells which he had taken at Darjiling some years ago.

ANADENUS MODESTUS, Theobald.

Limax modestus, Theobald, J. A. S. B. 1862, p. 489.
Anadenus modestus, Theob. Suppl. Cat. C. i. p. 65.
Second Yarkand Mission, Mollusca (G. Nevill), p. 21.
Nevill, Hand-list, p. 65 (from Changligalli, near Murree).

Original description:—"*Corpore limaciformi, postea acuminato, colore cinereo, fuscis punctis notato; dorso duobus lineis maculosis cateniformibus ornato, a sese et a margine equidistantibus et a pallio usque ad extremitatem extensis, spatio his lineis incluso paullo fuscente et elegante fuscis lineis striato et marmorato. Tentaculis quatuor rubro-fuscis.*

Longitudinis $1\frac{1}{2}$ unc.

"Habitat cum præcedente," *i. e.* the Cissutlej Mountains, near Fagu, Narkanda, Saraon, &c.

It is "much smaller and rather more elegantly shaped," and is, perhaps, rather more numerous than *altivagus*, though this is far from uncommon.

There is a very small species in the British Museum in the same bottle with *A. giganteus*, mentioned above, which appears immature, but is certainly another species. It measures—Total length 20 mm., mantle 9·0; breadth 5·5. It may be distinguished by its olive-brown colour and having the mantle speckled with black, and two well-marked lines of this colour on either side of the extremity of the foot; it agrees well with *modestus* of Theobald. I hope shortly to receive a collection of slugs from Darjeeling which may contain this species, for there is now some doubt whether *giganteus* of Heynemann was ever obtained there. This may possibly be the young of *A. schlagintweiti*, described by Heynemann on p. 141, *l. c.*; but he does not give any dimensions.

EXPLANATION OF PLATE VI.

Fig. 1. *Anadenus altivagus*, Theob.: animal, side view, nat. size. Spirit-specimen. Simla.
2. Ditto: respiratory orifice, × 4.
3. Ditto: ditto, with the anal aperture (*A.ap.*) adjacent, × 4.
4. Ditto: the generative aperture, × 4. Portion protruding showing the spines (*vide* Plate VII.).
5. Ditto: the jaw, × 7.
6. Ditto: teeth of radula, × 360. 6*a*, 6*b*. The outermost laterals.
7. Ditto: the generative organs, × 1½. *o.t.*, ovotestis; *h.d.*, hermaphrodite duct; *Al. Gld.*, albumen-gland; *ov.*, oviduct; *v.d.*, vas deferens; *P.*, male organ, with (*r.m.*) retractor muscle; *Sp.*, spermatheca.

EXPLANATION OF PLATE VII.

Fig. 1. *Anadenus altivagus*, Theob.: shell, × 2. Simla.
2. Ditto, nat. size. =*giganteus*, Heynemann; from his drawing, Taf. i. fig. 1 *g*.
3. —— *schlagintweiti*, Heynemann, nat. size; from his drawing, Taf. i. fig. 2 *e*.
4. Portion of back of *A. giganteus*, Heynemann; from his drawing, Taf. i. fig. 1 *h*, &c.
5. *Anadenus altivagus*, Theob. Simla. View of heart and renal organ, seen from below, showing position of the different muscle-attachments. *M.f.*, Mantle, frontal edge; *M.l.*, mantle, left side; *R.*, renal organ surrounding the ventricle; *i*, intestine; *r.m. T.*, *P.*, & *O.*, retractor muscle of eye-tentacles, penis, and odontophore respectively; *Res. Or.*, position of respiratory orifice.
6. The generative aperture cut open on the frontal side to expose the dart-sac, with its numerous spines and (*a*) the perforated shield; *b*, spines attached to the shield at its upper margin; *c*, larger and stronger spines attached to the posterior upper part of the sac; *d*, row of short spines extending to the generative aperture; *e*, outer integument of the animal; *e′*, muscular sac; *f*, the aperture into the vagina and spermatheca below this and inclining upwards to the left (*vide* fig. 7, Plate VI.); *v.d.*, portion of vas deferens.

Fig. 6 *a*. Upper portion of male organ (*P*), showing the termination of the vas deferens within the swollen portion where the retractor muscle is given off.
6 *b*. Diagrammatic vertical section of fig. 6, viewed from the side.
6 *c*. Horizontal section of same.
7. *Anadenus jerdoni*, n. sp., nat. size: spirit-specimen. Kashmir.

Genus Hyalimax, H. & A. Adams.

(Plate XI.)

The genus is indicated with the following very short description in 'The Genera of Recent Mollusca,' vol. ii. p. 219 (1858), type species *perlucidus*, Quoy & Gaimard:—"Orifice of respiratory aperture in the middle of the left side of the mantle; animal pellucid." This very imperfect description of a new genus was no doubt made upon Quoy and Gaimard's drawings and description of *Limax perlucidus*, Voyage l'Astrolabe, pl. xiii. figs. 10–13 (1832):—"Limax, *corpore ovali, depresso, perlucido, albo, punctis nigris notato; tentaculis minimis, crassis, nigro striatis; ossiculo corneo ovato*." Shell ovate, horny, with an indication of a whorl at the top. Male organ near the right tentacle; no caudal gland. *Habitat*. Pouce Mountain, Isle of France. Gray placed this species as the second in his genus *Drusia* (Cat. Pulm. Brit. Mus. 1855, p. 59), of which the first species and type was *Parmacella valenciennii*, Webb & Van Beneden, from the Hippurite Hills of Alcantara (Webb), Portugal. Adams was quite right in separating it from this European form. Even Gray, who gives a subcaudal gland as a character of his genus, says, "Intermediate between *Limax* and *Parmacellus*, Quoy. Though Quoy and Gaimard have not mentioned the subcaudal gland, I have ventured to place it in this family with doubt." There is no indication of this gland in the figures given of the animal.

Gray's genus *Drusia* is made up of a number of very different and distinct forms, and, as Fischer truly points out (Journ. de Conch. 1872, pp. 207, 208), has no value whatever and cannot stand.

In July 1867, Mr. P. Fischer, in the 'Journal de Conchyliogie,' p. 18, describes this genus most fully, and gives figures of it and its anatomy. As this genus is now to be included among our Indian Land Mollusca, I cannot do better than extract it in full, for the benefit of those who may not have access to the above journal.

"J'ai reçu de M. Deshayes un Limacien recueilli à l'île de la Réunion (Bourbon) par M. Maillard, le patient collecteur, dont nous déplorons la perte récente. Un premier examen suffit pour reconnaître ses affinités avec le *Limax perlucidus* de Quoy et Gaimard (Astrolabe, pl. xiii. figs. 10–13), signalé à l'Isle-de-France sur la montagne du Pouce. Le *Limax perlucidus* de Quoy est devenu le type du genre *Hyalimax* de MM. H. et A. Adams, c'est, par conséquent, sous ce nouveau nom générique qu'on devra désigner le Limacien de Bourbon: *Hyalimax maillardi*.

"L'animal est long d'environ 15 millimètres; le manteau est formé

complétement sur le dos et ne laisse apercevoir aucun rudiment de test; les bords forment cuirasse en avant et en arrière de la masse viscérale. L'orifice pulmonaire est situé à la partie moyenne du rebord du manteau (côté droit); le pied, assez large, se termine en arrière par une pointe, sans pore muqueux. L'orifice génital est placé à droite, à égale distance du grand tentacule et du bord du manteau; en dessous, la tête est séparée du reste du corps par un sillon bien marqué.

"En enlevant les téguments du dos on découvre une limacelle à peu près arrondie, très-mince, un peu bombée à sa face supérieure, et qui me paraît manquer de rudiment spiral; mais peut-être le trouverait-on sur des individus frais.

"La mâchoire est visible à l'extérieur par son bord inférieur; elle est très-remarquable et se compose d'un fer à cheval brun, épais, largement ouvert, très-finement strié vers les extrémités, à bord tranchant simple, non festonné, muni d'une dent obtuse à sa partie moyenne. Au-dessus du fer à cheval existe une lame ou support subquadrangulaire, allongé, étroit, analogue à celui des *Succinea* et des genres voisins.

"La plaque linguale est construite d'après le type ordinaire des Pulmonés herbivores; la denticulation médiane est étroite et son bord inférieur est tricuspide, mais les pointes descendent très-peu; les denticulations latérales, plus larges, portent en dedans une pointe assez longue et deux ou trois petites saillies externes; les dents marginales ne consistent plus qu'en séries, presque linéaires, de denticulations égales entre elles et extrêmement petites. Les dents linguales sont disposées sur des lignes plus obliques que dans le genre *Xanthonyx*. Les organes génitaux offrent très-peu de complication: la verge est longue, simple, enroulée sur elle-même; vers son extrémité, on trouve un muscle rétracteur. Le canal déférent la suit dans toute sa longueur et s'accole à une matrice très-contournée et festonnée, sans renflement spécial près de l'orifice commun génital. La glande albuminipare est globuleuse, divisée en lobes très-nombreux; le canal excréteur de la glande en grappe est très-tortueux au point où il s'accole à la glande albuminipare.

"La poche copulatrice, placée à l'extrémité d'un col très-long et simple, est petite, arrondie; un muscle rétracteur s'insère sur ses parois.

"Le *mollusque* de Bourbon est donc un *Limacien* par sa coquille complétement interne, mais sa mâchoire le rapproche des *Succinea*; le peu de complication des organes génitaux établit un rapport de plus entre ceux-ci et le genre *Hyalimax*.

"Il existe, par conséquent, parmi les mollusques du groupe des *Succinea* une série très-complète analogue à celle des Arionidæ ou des Limacidæ, et dont les principaux termes sont:

"1°. Coquille contenant entièrement le mollusque: *Succinea*, *Simpulopsis*;

"2°. Coquille ne recouvrant qu'une portion de l'animale *Omalonyx*.

"3°. Coquille cachée complétement par le manteau : *Hyalimax*.
"4°. Coquille absente ou tout à fait rudimentaire : *Janellia*, *Aneitea*, etc.

"La forme de la mâchoire des *Hyalimax* les distingue de ces divers genres ; c'est une combinaison des caractères de celle des *Zonites* (pour le bord) et des *Succinea* (pour le support) ; le genre *Hyalimax* est donc établi très-légitimement ; mais nous sommes certain que MM. Adams ne pensaient pas, en le créant, qu'il viendrait un jour se ranger auprès des *Succinea*."

In July 1872 the same author published another paper on the species of this genus (Journ. de Conch. p. 202); and he describes in detail Rang's species *Parmacella mauritius*, which he places in *Hyalimax*, after showing the points of similarity with *H. maillardi*, Fischer. The dentition is also of the same type; but I note that the dental formula given on p. 205 is 120 . 1 . 120, thus differing very considerably from that of *H. andamanica* ; and he concludes by saying :—"Le genre *Hyalimax*, forme aberrante des Succineidæ, est le dernier degré de l'aplatissement de la coquille des *Succinea*. Ainsi l'animal des vrais *Succinea* est contenue dans sa coquille ; chez les *Homalonyx*, la coquille ne recouvre qu'une partie du corps ; chez les *Hyalimax* elle devient interne. Les *Hyalimax* sont les équivalents, dans les îles Africaines, des *Homalonyx* de l'Amérique."

HYALIMAX (JARAVA) ANDAMANICA, n. sp. (Plate XI. figs. 1, 2, 3, and 4.)

Hab. Near Port Blair, Andaman Islands.

The animal is thus described by my brother, Mr. Harold Godwin-Austen, who sent me four specimens. "Pale watery green, yellower on the mantle, with alternate stripes of torquoise-blue and chocolate on the upper part of the neck." These darker lines I suspect are the retractor muscles of the eye-tentacles ; the animal when living would appear to have a much flattened wide foot, thin, and spreading at the margin, for in the spirit-specimen it is much wrinkled ; the extremity of the foot is pointed, with no mucous gland. There is no defined pallial margin to the foot ; distinct grooves run at intervals from the dorsal edge of the mantle to the side of the foot ; and two of the specimens show a few distinct dark spots on the upper surface of the extremity of the foot. An indistinct median area on the sole of the foot. Eye-tentacles apparently stout. I am in doubt regarding the oral tentacles ; and if present, they are probably small. The mantle is continuous over the shell, and covered with minute papillæ ; there is no division into right and left shell-lobes ; the dorsal lobes are very much reduced in size, the right dorsal lobe particularly so, being very narrow and only extending to the posterior margin ; the left dorsal lobe is also very narrow, and only just separated from the mantle, terminating on the left anterior side. The respiratory orifice (fig. 3) is just behind the centre of the right side of the mantle, a short distance above its lower edge. The anal orifice,

fig. 3 (*A*), is some distance (3 mm.) behind it, and concealed by the mantle, its position being quite on the right posterior margin.

Length of spirit-specimen 16·0, mantle 11·0, breadth 5·5 mm.
,, ,, 0·65 ,, 0·45, ,, 0·23 inch.

The shell (fig. 4) is ovate, thin, flat, transparent, milky white, with close concentric ridges of growth, very thin and delicate on the margin; the apex rather more solid and quadrate at that end, the nucleus being on the right margin.

Size: Major diam. 5·0 mm., minor diam. 3·3 mm.
,, 0·20 inch, ,, 0·13 inch.

Odontophore &c. The buccal mass (fig. 6) is large; the strong retractor muscle has its attachment, together with that of the eye-tentacles, in the usual position at the posterior side of the mantle-margin; but the posterior portion of the buccal mass is very different to what we find in other species: it is more truncate; and that part where the lingual ribbon takes its origin, and which in all species I have hitherto examined presents a shortish blunt knob-like process, in this species is represented by two coils, which are really the posterior edges of the lingual ribbon, turned up on each side and coiled on itself inwards. The lingual ribbon is broader than it is long; and 92 rows were counted, each containing at least 530 teeth.

265 . 1 . 265.

The central tooth (fig. 8) is 4-cuspid and much hooked. The laterals are all alike, very gradually becoming smaller on the outside; they bend over in a claw-like form, and are edged with four cusps, of which the two outermost are slightly longer than the two inner; a very minute cusp can just be discerned in some of the largest laterals near the centre, at the exterior base of, and next the first long inner cusp.

The jaw (fig. 7) is very peculiar. It is a very dark umber colour; the cutting or frontal edge forms an oblique angle; and the muscular attachment is very strong and extends back at right angles, equal in length to the width of the jaw, which is T-shaped as in *Succinea* &c.

The heart (*vide* fig. 5, *V*) is situated on the left anterior margin of the mantle. The position of the anus is very far back on the right posterior side, quite removed from the neighbourhood of the respiratory orifice, its usual position in most genera; and this is perhaps the most interesting point in the anatomy of this species. The intestine terminates in a large expanded sac just within the aperture.

Generative organs (fig. 9). The ovotestis, hermaphrodite duct, and albumen-gland were not made out. The oviduct (*ov.*) is much convoluted for a short distance, and then extends in a long straight duct to the generative aperture; the prostate is of same length, the vas deferens running parallel to the straight portion of the oviduct down to a short bulbous expansion, to which it is probable the retractor muscle is given off; but this was not found in either specimen examined. The spermatheca (*Sp*) is of very great length; a long

and thin tube terminating in a round ball-like expansion, which is like in this respect to *H. maillardi*. *Hyalimax andamanica*, however, differs from this Bourbon species (1) in the form of the jaw, which has no indication of a central projection; (2) there is considerable divergence in the shell, and I give a drawing of that of *H. perlucidus* (fig. 10), from Mauritius, received by me from Mr. G. Nevill, which shows the apex to be very attenuate and sharp, and there is a distinct greenish epidermis; (3) the dental formula is different; (4) Fischer does not indicate the position of the anal aperture, which, situated in *H. andamanica* so far back on the posterior right margin, is of extreme importance, so that if otherwise in *Hyalimax* of Bourbon, and in its usual position adjacent to the respiratory orifice, it may render it necessary to place the Indian form in another subgenus, which I would name Jarava, from the name of the aboriginal tribe that inhabit the South Andaman Islands. In this case a subfamily Hyalimacinæ would include 1. *Hyalimax* (*perlucidus*, Isle of France; *mauritianus*, Isle of France; *maillardi*, Bourbon), and 2. *Jarava* (*reinhardi*, Nicobars; *andamanica*, Andamans; *viridis*, Arracan).

In the form of the buccal mass, the broad radula and its numerous teeth, *andamanica* resembles in a remarkable manner the curiously formed New-Zealand slug *Janella antipodarum*, Gray, described and figured by Mr. C. Knight in the 'Transactions of the Linnean Society,' vol. xxii., read June 2, 1859; and they all must be regarded, with *Succinea* and others, as one great group, indicated so well and on such good grounds by Mr. P. Fischer.

From the islands of the Bay of Bengal we also have another species

Hyalimax (Jarava) reinhardi, Mörch.

Hyalimax (*Jarava*) *reinhardi*, Mörch, Journ. de Conch. July 1872, p. 314.

Original description:—"*C. linguæforme, postice acuminatum, pallide increscens. Ommatophoria cærulea. Tentacula brevissima. Pallium ellipticum, prasinum, orificio respiratorio in medio marginis dextri sito. Notæum pedis sulcis radiantibus distantibus et sulco obsoleto peripherico circumdatum. Testa scapulæformis, latere dextro recto. Maxillæ crista muscularis angusta, longitudinis fere dimidium maxillæ.*

Long. 45 mill., long. pallii 22 mill., lat. 11 mill., long. notæi pedis 17 mill. (ex icone).

"*Hab.* Pulo Panjang et Sambelong. Cette espèce a été recueillie sur le côté inférieur des feuilles de Calderon et d'autres végétaux à feuillage épais. L'animal se tient habituellement immobile et contracté, en effectant une forme ovale. L'attache musculaire de la mâchoire est plus étroite et plus allongée que chez l'*H. maillardi*, Fischer (J. Conch. 1867, p. 218, t. x. f. 5, 9)."

This species would appear to be very similar to the Andaman form, but larger; until, however, they are compared together in greater detail, or we obtain drawings of the animals from life, I think it best to keep them separate.

Hyalimax (Jarava) viridis, W. Theobald.

Hyalimax (*Jarava*) *viridis*, W. Theobald, J. A. S. B. 1864, p. 244.

Original description:—"*Corpore expanso, pone acuminato, flavo cinereo. Pallio magno, læte colorato viridi-flavo limonis. Tentaculis superioribus longis, pallidis, oculos parvos nigros gerentibus; et linea pallide smaragdina ad basin notatis. Tentaculis inferioribus minutissimis.*

"*Habitat* inter folia in dumetis marinis 'mangrove' dictis apud littus Peguense, prope fines provinciæ Arracan.

"This elegant little *Limax* is very active, and creeps about briskly on the green foliage of the salt swamps, which (*i. e.* the leaves) it resembles in colour."

There can be but little doubt, from the above description and the habitat, that this species must find a place here: how far it extends north, and whether *Hyalimax* occurs in the Sunderbunds it would be interesting to learn; but it may certainly be looked for there, especially on the eastern side, near Chittagong.

EXPLANATION OF PLATE XI.

Fig. 1. Animal of *Hyalimax* (*Jarava*) *andamanica*, from spirit-specimen, right side, × 4.
2. Ditto, viewed from the left side.
3. Ditto, right side, showing the position of the respiratory and anal orifices.
4, 4 *a*. Ditto: shell, × 8 and natural size.
5. Ditto: view from below, × 4. *A*, anal aperture; *V*, heart; *Res.or.*, respiratory aperture; *r.m.T.*, retractor-muscle tentacles; *r.m.B.*, ditto, buccal mass.
6. Ditto: much enlarged view of the buccal mass, showing the form of its posterior end. *s*, salivary-gland duct.
7. Ditto: jaw, × 20.
8. Ditto: central teeth of the radula, × 1250.
9. Ditto: generative organs, × 8.
10. Shell of *Hyalimax perlucidus*, Quoy and Gaimard, from Mauritius.

Genus Geomalacus.

The genus *Geomalacus* was first discovered by William Andrews, Esq., of Dublin, in 1842, and first described at a meeting of the Dublin Natural-History Society, in January 1843, by Prof. G. J. Allman, who afterwards gave a full account of it, with a drawing of the animal, in the 'Annals and Magazine of Natural History,' for May 1846, vol. xvii. p. 297, the original description being as follows:—

"Gen. Char. *Corpus productum, lanceolatum, carinæ expers; pallium scutiforme, ovatum; spiraculum in margine anteriori pallii; foramen genitale pone radicem tentaculi minoris dextri; testa solida, plana, subovata. Ab* Arione *differt hoc genus situ foraminis genitalis, a* Limace *cauda glandulifera et situ anteriori spiraculi.*

"G. maculosus, *unica species quam in rupibus madidis comitatus Kerriensis repentem invenit Gulielmus Andrews.*

". . . . It is an exceedingly beautiful animal, measuring when

creeping about 2 inches in length; the colour of the shield and upper part of the body is black, elegantly spotted with yellow; the under surface of the foot light yellow, and divided into three nearly equal bands; the edge of the foot is brown with transverse sulci. Besides the typical variety, which is that now described, a second is occasionally met with; it is characterized by the spots being of a pure white."

Professor Allman then proceeds to show how this genus differs from *Arion* and *Limax*, and considers that it approaches more nearly to the former than to the latter. I am inclined to think it is equally distant from both—the position of the generative aperture in *Arion* just below that of the respiratory, which is an excellent character, places it very wide of that genus, much more than the presence of the mucous gland at the extremity of the foot separates it from *Limax*; while the forward position of the respiratory aperture is not a character of very much importance; whereas the position of the generative orifice in *Arion*, and adjacent to the respiratory, alters altogether the arrangement and form of the other organs of the body, the site of muscle-attachments, &c. The size of the rudimentary shells in these genera of slugs does not very much affect the question of their respective affinities.

I have lately, owing to the kindness and liberality of Dr. A. Günther, of the British Museum, been able to examine the animal of this genus more closely, and look at other characters, which place it altogether in a more remote and isolated position as regards both *Arion* and *Limax*. At the same time the possession of species of the genus *Anadenus*, Heynemann, from the Himalaya, which I have already figured and described, shows that *Geomalacus* is more nearly related to that genus than those above mentioned. It is for this reason, and that we may compare the characters of both, that I enter more fully into and figure some of the internal organs of this very restricted European genus.

As the position and attachment of the large retractor muscles in these creatures bear somewhat the same relation to its body, as regards its outer form, when in motion or at rest, as the development of the muscles in the Vertebrates effects and modifies the size and form of their skeleton, importance should be paid to this part of their anatomy; and it is found that in many genera the position of these muscles where given off changes from a posterior to a more anterior one, showing in this respect a greater departure from some original type.

Geomalacus maculosus, Allman. (Plate XII.)

Geomalacus maculosus, Allman, Ann. & Mag. Nat. Hist. xvii. p. 297, pl. ix. (May 1846); Forbes & Hanley, vol. iv. p. 12, pl. F F F*. f. 5 (1853).

G. maculatus, Adams, Genera, p. 228, pl. lxxx. ff. 4, 4 *a* (1858).

? *Limax anguiformis*, Morelet, Moll. Port. p. 36, pl. iii. f. 1.

G. maculosus, Gwyn Jeffreys, Brit. Conch. i. p. 129, pl. v. f. 3 (1862); Bourguignat, Class. Fam. Moll. vivants, p. 14 (1877); J. Mabille,

Revue et Mag. Zoologie, January, p. 53 (1867); Lovell Reeve, Land & Freshwater Moll. British Isles, p. 13 (1863); J. Mabille, Annales de Malac. p. 120 (1870).

Loc. An island in Dingle Bay, west coast of Ireland. Coll. Brit. Mus.

Shell (Pl. XII. fig. 2) covered on the outside with a very thin transparent epidermis. The mucous gland is very small (figs. 1, 1*a*), the pedal margin of the foot very distinct and similar to that of *Arion*. The renal organ is triangular in form, its nearly equal sides completely surrounding the heart (fig. 8), which is thus central as regards that organ, as in *Arion* (fig. 9); but in that genus the form of the renal organ is lunate. The ventricle is directed towards and very close to the anal and respiratory orifices, while in *Arion* it is more remote and in a more posterior position. These differences in position and form of the renal organ in this genus, *Arion*, *Anadenus*, and *Limax* are shown in fig. 10, where it lies alongside the heart and posterior to it.

Retractor muscles. Those of the two eye-tentacles (*r.m.T.*, fig. 8) are attached at the right and left posterior margin of the mantle, that of the odontophore or buccal mass (*r.m.O.*) just behind the attachment of the right eye-tentacle; while that of the penis is situated far back near the extremity of the foot on the left posterior side. Now in *Arion* the attachments of the eye-tentacles and odontophore are closer together at the posterior margin of the mantle, and that of the penis is here also occupying a middle position between the muscles of the eye-tentacles.

If we examine *Limax* again (fig. 10) we find a still greater divergence. The retractor muscle of the penis (*r.m.P.*) is anterior, on the mantle-margin, and that of the eye-tentacles and buccal mass (*r.m. O., E., T.*) are all close together on the posterior right margin.

Odontophore. The jaw is distinctly ribbed, solid, dark brown in colour; concave in front, with a sharp edge. The dental formula is

59 . 1 . 59.

The central tooth is unicuspid, rather short and broad; the median teeth are long, sharply pointed, with a very small notch or cusp at the outer basal margin. This becomes better developed in the lateral teeth; up to the 14th or 15th median the teeth are uniform in size, but they then become gradually smaller towards the sides, and about the 46th are much broader at the base, with the outer tooth well developed; the last five or six are very minute, and the cusps blunt and irregular. In the form of these laterals and the radula generally it has a most interesting similarity to that of *Anadenus*, which also has a ribbed jaw. It is quite unlike *Arion* in this character of the radula. In one specimen the teeth were quite worn down in the centre, so that the points were reduced to a blunt knob. The stomach of this individual contained a considerable quantity of coarse angular sand mixed with the food, which appeared derived from granite rocks.

Generative organs. I have dissected two specimens, and both

were similar in every way. There is nothing remarkable from the ovotestis to the oviduct and vas deferens. The male organ and spermatheca, however, are peculiar. The retractor muscle is, of course, very long, as it extends so far back in the body-cavity. The vas deferens is very long, and very much twisted and convoluted on itself, and in a portion of this twisted length the capreolus is no doubt formed. The spermatheca is not attached to the generative apparatus by a separate duct of its own, but rises close to and beside the retractor-muscle attachment, its duct running with, as if forming a part of, the penis. Now if we look at the generative organs of *Anadenus* (Plate VI. fig. 7) there is a good deal of similarity in the form of the long coiled vas deferens, and we have only to unite the duct of the spermatheca to that of the penis to bring about what is seen in *Geomalacus*. On opening out the vagina of *Geomalacus*, there is found a curious arrangement of the flattened folds, of which the central part with pointed end, situated close to the genital aperture (*Gen.Ap.*), may be the homologue of the dart in other genera.

Monsieur Jules Mabille has given (*l. c.*) a paper on the genus *Geomalacus*, and enumerates some seven species, and he points out the differences between it and more or less similar genera. He is, however, over-critical, I think, on the English drawings that have been given of *G. maculosus*; for that in the 'Annals and Magazine of Natural History' is, I consider, a very good representation of the animal, judging from spirit-specimens, and it shows clearly the very distinctive mottled skin of the animal; it does not profess to give a magnified portion of the skin drawn from life and the minute white specks alluded to in the footnote, a character which is not an all-important one. When we examine the descriptions of the new species we find that they depend entirely on outward characters alone, so that M. Mabille leaves much to be desired; and it will be an interesting and useful task if some French naturalist will take up the examination of the internal characters of these slugs.

G. andrewsi, occurring in the same part of Ireland with *maculosus*, can only be considered a variety, with more white than black.

At the time when Forbes and Hanley, Mr. Gwyn Jeffreys, &c. recorded this slug in their works as a Great-Britain form, it was not known to occur in France. The last-named author pointed out that *anguiformis*, Morelet, of Portugal probably belongs to the same genus, and goes so far as to think it may be even the same species as *maculosus*, so that it was not at all unexpected by English naturalists that the genus should be found in France, a very natural range for it; how far it may extend eastward is now the point that interests us. From what is now known, its present range is the west of Europe and the countries on the Atlantic sea-board.

List of recorded Species of Geomalacus.

G. maculosus, Allman: type. Ireland.
G. andrewsi, var., Mabille. Ireland.
G. anguiformis, Morelet. La serra de Morichique, Algarve, Portugal.
G. intermedius, Normand. Valenciennes, France.
G. bourguignati, Mabille. Forêt de Meudon, Paris.
G. paladilhianus, Mabille. do. do.
G. moitessierianus, Mabille. do. do.

These three last, I should conclude, are the same species in different stages of growth.

In a paper entitled "Des Limaciens Français," *l. c.* (1870), M. Mabille records also

G. mabilli, Baudon, Journ. Conch. viii. p. 142 (April 1868). Mouy-de-l'Oise.

G. vendeianus, Letourneux, Rev. et Mag. Zool. t. xxi. p. 7. Bois-Plat, Fontenay-le-Comte (Vendée).

Key to Genera of Limacidæ *and* Arionidæ.

External characters.	Genus or Subgenus.
A. Animal with a complete oval mantle; generative aperture near the right tentacle.	
a. With shell rudimentary, internal.	
a'. Jaw smooth, simple, with central projection.	
a''. Anal aperture close to respiratory orifice.	
a'''. Foot pointed; no mucous pore.	
a^4. Respiratory orifice on the posterior right margin of mantle.	
a^5. Extremity of foot keeled	*Limax*.
aa. Mantle papillate	(*Amalia*), Moquin-Tandon; (*Milax*), Gray.
bb. Do. with concentric ridges ...	(*Eulimax*), Moquin-Tandon; (*Limax*), Gray.
b^5. Foot rounded above	*Limacus*.
b^4. Respiratory orifice in middle of mantle.	
b. Shell with well-developed spire; foot keeled..	*Parmacella*.
b'. Jaw ribbed	*Anadenus*.
b'''. Extremity of foot with mucous gland.	
c^4. Respiratory aperture on anterior right margin	*Geomalacus*.
B. Generative aperture below the respiratory......	*Arion*.
cc. Shell rudimentary (calcareous particles not united)	(*Lochea*), Moquin-Tandon.
dd. Shell with slightly united granulations	(*Prolepis*), Moquin-Tandon.

Key to Genera of Limacidæ *and* Arionidæ (*continued*).

External characters.	Genus or Subgenus.
C. Anal aperture on the posterior right margin of the mantle removed from the respiratory orifice.	
c'''. No mucous gland.	
d^4. Respiratory orifice in middle of mantle	*Hyalimax.*

Internal characters.	
A. Rectum close to respiratory orifice.	
a. Muscle-attachment of penis *anterior* to edge of mantle.	
a'. Renal organ lying alongside the heart	*Limax.* *Parmacella.*
b. Muscle-attachment of penis *posterior* to edge of mantle.	
b'. Renal organ partly surrounding the heart ...	*Anadenus.* *Arion.*
c. Muscle-attachment of penis near extremity of foot	*Geomalacus.*
B. Rectum behind the respiratory orifice, and radula of different type	*Hyalimax.*

EXPLANATION OF PLATE XII.

Fig. 1. *Geomalacus maculosus*, Allman: side view of extremity of foot, with mucous gland, from spirit-specimen. *a*, view from behind of ditto.
2. Ditto: shell, × 7.
3. Ditto: jaw, × 20.
4. Ditto: teeth of radula, × 360. 4 *a.* 12th to 18th; 4 *b.* Outermost laterals.
5. Ditto: generative organs, × 2.
6. Ditto: ditto, portion of, from second specimen. Male organ.
7. Ditto: the basal portion of male organ, laid open. *Gen.Ap.*, position of generative aperture; the external opening is on the other side.
8. Ditto: position of renal organ, heart, and the retractor muscles, viewed from below, × 3.
9. *Arion ater.* Reigate. Position of above organs, similar view, × 2.
10. *Limax agrestis*, Müller: ditto, ditto, × 3. *M.f.*, mantle, frontal edge; *M.l.*, mantle, left margin; *r.m.O.*, *T.*, *P.*, retractor-muscle attachments of odontophore, eye-tentacle, and penis; *s*, position of apex of shell.

Genus Helicarion, *Férussac.*

I have been able lately to examine the animal of a species of this genus from Australia, kindly sent me, together with other interesting shells, by Dr. J. C. Cox, of Sydney, who has worked so long and so well at the shells of that country. The specimen is close to *H. hyalina*, Pfr., and is referred to in Dr. Cox's 'Monograph of Australian Land Shells' (1868), p. 85. I have named it *coxiana*, and shall refer to the anatomy when describing the Indian species that have been hitherto placed in this genus. I may now state that the Australian form differs in this respect very materially from the East-Indian; that from Sydney, I find, resembles exactly that of *Helicarion freycineti*, Quoy and Gaimard, from New South Wales, figured so well in Dr. C. Semper's 'Reisen im Archipel der Philippinen,' pl. iii. fig. 6.

Girasia of Gray is a very distinct subgenus of the Helicarionidæ.

LAND AND FRESHWATER MOLLUSCA

OF

INDIA.

Part III.—JANUARY 1883.

(Plates XIII.-XXI.)

The shells that are now figured on Plates XIII. to XVII. are all of very small size, and many of them are described for the first time. I had hoped in this Part to be able to figure some of the small operculated shells which are included in Mr. Sylvanus Hanley's "Systematic List of Species" in the 'Conchologia Indica,' though not figured in that work, and the large number that have been found since; but I have thought it best to continue the minute Zonitidæ, and record the little-known forms of this family before entering on another.

It has become somewhat a difficult matter to know under what genus to place most of these little shells. We know nothing of the animals, still less of their anatomy: in the case of some species it is doubtful even to what family they belong; for instance, the more or less depressedly pyramidal shells on Plate XVI. are transversely sculptured like *Kaliella*, and I bring them into that subgenus. In India the Zonitidæ altogether exceed the Helicidæ in number, and those genera and subgenera which come into the latter family are mostly of large and characteristic form.

I am therefore obliged to group them, to a certain extent, by outward form of shell and the sculpture well magnified; and as this depends almost entirely on the form and action of the mantle, it is of a certain value. Thus guided by sculpture, those shells figured on Plate XIII. approach the subgenus *Sitala*, for longitudinal ribbing is characteristic of all and is always well seen on the base and apex, though somewhat obliterated on the face of the whorls by the transverse lines of growth. In the strong epidermis of some, hirsute in others, or very oblique undulate ribbing there is much divergence; and these again merge into forms like *Macrochlamys*, as shown on Plate XIV., to which I suspect several belong.

For some of these species we might establish subgeneric titles, and they will perhaps be necessary to complete the chain of classification; it is better, however, to wait and learn more about them

before doing so. *Helix conulus*, Blf., stands alone, a very peculiar form, which cannot be put in any of the genera I am now figuring. Blanford placed it in *Kaliella* with doubt, and I follow him. The examination of the odontophore of a species on Plate XV. shows close relationship with *Kaliella*; and the dissection of a species (figs. 1 & 2 on Plate XVII.) from Cherra Poongee settles definitely the position of most of the shells on that Plate in the genus *Macrochlamys*, and thus leads up through these small forms to the illustration of it in detail on Plates XVIII., XIX., and XX. On Plate XXI. I give drawings of the sculpture of several species of Zonitidæ, which I found useful when roughly grouping them together.

The description and synonymy of *Macrochlamys indica* will be given in Part IV., together with *tugurium*, *petrosa*, *resplendens*, *decussata*, and other large species of the genus, which perhaps contains more species than any other in the Indian Region, and those species exceedingly variable in form.

With reference to the discovery of *Kaliella* in Madagascar, Mr. Edgar Smith writes as follows, in the P. Z. S. for 1882, p. 375:—" One minute species, *H. barrakporensis*, has not previously been met with except in India, where it may have been introduced, as is the case with the large *Achatina fulica*, a most abundant shell in some parts of Madagascar and also at the Mauritius." The introduction of this last by Mr. Benson into Calcutta is well known; and since then it has spread all over Calcutta and its suburbs up to Barrakpur, where I have seen it, and across the Hooghly into the Botanical Gardens, the eggs, no doubt, transported in the roots of garden plants. It has thus become a perfect pest—a somewhat similar and questionable benefit to the country as the introduction of the rabbit and sparrow has been to Australia. Now *Kaliella barrakporensis* is not a parallel case, but one that must remain an example of great extension of a species. It is a most abundant shell over a vast area of country from the Sundabunds to the Himalayas, there being few small shells so abundant.

Family ZONITIDÆ (*continued*).

Subgenus Kaliella (*continued from page* 24).

Kaliella lailangkotensis, n. sp. (Plate XV. figs. 1, 1 *a*.)

Locality. Lailangkote, Khasi Hills (*H. H. G.-A.*).

Shell depressedly conoid, subangular on periphery, closely umbilicated; sculpture, covered with a strong epidermis, well ribbed transversely, crossed by regular longitudinal fine ribs; colour pale ochre; spire low, blunt; suture impressed; whorls 5, somewhat flattened; aperture subvertical; peristome sinuate below, thin, columellar margin oblique.

Size: major diam. 4·8 mm., alt. axis 2·3 mm.
,, 0·19 inch, ,, 0·09 inch.

This shell is very abundant at Lailangkote among the large weathered masses of granite there; but it was found also at Mairang, Teria Ghat, Maotherichan Peak, and Mokarsa.

From one of these dried specimens I have been able to extract the labial ribbon and jaw, which I figure on Plate XX. The central tooth is tricuspid, the centre cusp long; the next five median teeth are rather broad, pointed, long, with small denticles on both the outer and inner basal sides; the sixth and seventh are similarly tricuspid; from the eighth outwards all are bicuspid, but the outer cusp never reaches to the same length as the inner. In this respect this dentition differs from that of *Macrochlamys*. The dental formula is

26 . 2 . 5 . 1 . 5 . 2 . 26
33 . 1 . 33

The jaw is simple, the cutting-edge concave, with a low convexity in the median area.

The mantle-lobes could not be made out in this specimen.

The central and median teeth are thus as in *Kaliella* and the formula is the same; the only difference lies in the laterals being bicuspid in this species. This character of the odontophore, together with the keeled form of the shell, shows that it should be placed in that subgenus together with other species on Plate XV.

Two specimens of this shell have been sent me by Mr. G. Nevill (collected by Mr. Robert in the Naga Hills) as no. 209 of his 'Hand-list,' *Nanina* (*Microcystis*), n. sp., p. 42, "14, Naga Hills, coll. Major Godwin-Austen, W. Robert, and A. W. Chennell, Esqs." I do not possess a single specimen from that district; there must have been some mixing of shells here.

Kaliella kezamahensis, n. sp. (Plate XV. figs. 3, 3 *a*.)

Locality. Kezamah, Anghami Naga Hills; Gaziphima, Naga Hills (*H. H. G.-A.*).

Shell subturbinate, well umbilicated, covered with strong epidermis, base flat; sculpture rather coarse, decussate, like cloth, the transverse ribbing the strongest; colour, specimen bleached; spire conoid, sides convex, apex blunt; whorls $5\frac{1}{2}$, convex, keeled sharply on last; aperture semilunar; peristome rather thickened, very oblique near axis.

Size: major diam. 4·1 mm., alt. axis 2·0 mm.
,, 0·16 inch, ,, 0·08 inch.

I have been successful in extracting the labial ribbon of this species, which is the same as that of the preceding (*lailangkotensis*) as regards the central or median teeth being tricuspid, only that it does not possess the two transitional teeth between the median and laterals; and these last are more distinctly unilateral, the outer cusp being situated near the base and never rising so high towards the point as in *lailangkotensis*. The formula is

25 . 6 . 1 . 6 . 25
31 . 1 . 31

Jaw not seen. With this specimen I was also fortunate to find the spermatophore, which will be figured in the next Part with the above odontophore.

KALIELLA ? BURRAILENSIS, n. sp. (Plate XV. figs. 5, 5 *a*, 5 *b*.)

Locality. Burrail range, Naga Hills (*G.-A.*).

Shell closely umbilicated, depressedly conoid, keeled ; sculpture, on base well-marked radiating ridges of growth, crossed by fine concentric ribbing ; colour pale dull ochraceous ; spire, sides flatly convex, apex rounded ; suture very shallow ; whorls 5, flat ; aperture narrow, semilunate ; columellar margin oblique.

Size : major diam. 5·7 mm., alt. axis 2·4 mm.
,, 0·23 inch, ,, 0·10 inch.

This shell approaches *K. ruga* in its form, but has not got the small indentation on the base of the last whorl ; it may also at first sight be mistaken for both *lailangkotensis* and *kezamahensis* ; but its close umbilication and large size distinguish it. Only two specimens were obtained.

KALIELLA ? RUGA, n. sp. (Plate XV. figs. 4, 4 *a*.)

Locality. Phúnggam, Lahúpa Nága Hills, on the trap-boss near the village ; Shiroifurar Peak, 9000 feet (*H. H. G.-A.*).

Shell depressedly turbinate, well rounded below, umbilicate, covered with strong epidermis, with a single palatal plica or tooth within the aperture * ; sculpture like cloth, irregular, coarse, the transverse ribbing the strongest, below smoother, with a few transverse ribs ; colour pale horny brown ; spire low, sides convex, apex flat ; suture slightly impressed ; whorls 5, regularly increasing, the last angular at periphery ; aperture narrow, sublunate, vertical, the tooth-like process just within on lower margin, this is oblong, blunt, but slightly raised and directed obliquely backwards, and in some specimens two are to be seen, one behind the other ; this tooth appears to be formed during periods of arrested growth, the old edge of the aperture being apparent near it ; peristome thin, thickened towards the columellar margin, which is much oblique to the axis.

Size : major diam. 3·6 mm., alt. axis 1·8 mm.
,, 0·14 inch, ,, 0·07 inch.

KALIELLA ? NEVILLI, n. sp. (Plate XIII. fig. 6.)

Locality. Darjiling.

Shell subpyramidal, openly umbilicated, thin, fragile, subangulate, the periphery ornamented with a line of hairs, which are pointed ; sculpture very oblique and distant, well-marked costulation ; colour olive-brown ; spire conoid, sides flat ; suture well impressed ; whorls

* A similar palatal tooth to this is found in *H. helicifera*, Blf., from Arakan, of which I shall hereafter give a drawing, as it is not shown in the figure in the 'Conch. Indica,' nor is the peculiar columellar margin very well delineated.

5, last well rounded below; aperture very ovate; peristome thin and scarcely reflected.

Size: major diam. 0·30, alt. axis 0·14 inch.
,, 7·7 ,, 3·5 mm.

This species was sent me by Mr. Geoffrey Nevill, from the Indian Museum collection, Calcutta, where the type figured will be sent. It was, I believe, discovered by Colonel Mainwaring. Its generic position is very doubtful.

KALIELLA ? CONULUS, W. T. Blanford. (Plate XV. figs. 6, 6 *a*.)

Sec. *Kaliella*? *Nanina conula*, W. Blf. J. A. S. B. 1865, pt. 2, vol. xxxiv. p. 73; Pfr. Mon. Hel. vol. v. p. 89; Conch. Ind. p. 52, pl. cxxix. figs. 5, 6.

Kaliella, sec. A, Theob. Supp. Cat. p. 20.

Locality of figured specimen. Jatinga valley, North Cachar Hills, and I have one other shell from Munipur.

Sculpture, longitudinal fine ribbing, most marked on the apical whorls, crossed by fine, irregular, very oblique striæ; colour white.

There is one of the four original specimens in Mr. W. T. Blanford's collection, fixed upon a glass slide, with which I have compared the above, but it was too thin and delicate a shell to remove for figuring; they agree perfectly.

Size: major diam. 3·1, alt. axis 2·9 mm.

Original description:—"Shell subperforate, turreted, white, horny, thin, translucent, marked with oblique sinuous subfiliform costulate striation, and below the centre of the whorl with very fine spiral lines, only visible under a powerful lens; spire conical, apex rather obtuse; suture deeply sunk. Whorls 6, very convex, keeled in the centre, the keel very fine, raised, thread-like, opaque and white; the last whorl bicarinate, the second raised spiral line being below the periphery; flatly convex beneath, and marked by radiating striæ and concentric impressed lines. Aperture oblique, tumidly and subangularly lunate, about equally broad and high; peristome thin; margins distinct; columellar nearly vertical, very briefly reflexed at the penultimate whorl.

"Diam. $1\frac{3}{4}$ mm. = 0·07 inch.
"Height 2 ,, = 0·08 ,,
"*Hab.* Phoung-do, Arakan.

"A minute species, remarkable for its keeled and convex whorls. Only four specimens were found."

It would be interesting to know the anatomy of this species and the relationship to its neighbours.

KALIELLA ? LEITHIANA, n. sp. (Plate XVI. figs. 6, 6 *a*, 6 *b*.)

Locality. Ceylon (*ex coll. Dr. Leith*).

Shell narrowly umbilicated, discoid, keeled, base flat; sculpture covered with an olivaceous epidermis, irregular transverse lines of growth; spire very depressedly conoid, sides flat, apex blunt; whorls $6\frac{1}{2}$, all very equal in breadth, flat; aperture elongate, narrow, perpendicular; peristome thin, columellar margin upright, short.

Size: major diam. 7·0 mm., alt. axis 2·4 mm.

This specimen was purchased from a dealer, having come from the late Dr. Leith's collection; it was still on the original card he had gummed it on, so that the habitat can be trusted. It is to be regretted the exact locality is unknown, as I have only one specimen. However, it may be well known to others who have collected in the island of Ceylon.

Kaliella ? dikrangensis, n. sp. (Plate XVI. fig. 3.)

Locality. Dikrang valley, Dafla Hills, Assam (*H. H. G.-A.*).

Shell globosely conoid, keeled, imperforate, much rounded below; sculpture, very microscopic, transverse regular costulation, the finest I have seen; colour pale amber; spire pyramidal, sides nearly flat, apex well rounded; suture moderately impressed; whorls 6, closely wound; aperture narrowly quadrate; columellar margin strong, perpendicular, with a slight protuberance on the inner margin.

Size: major diam. 1·6 mm., alt. axis 1·1 mm.
,, 0·065 inch, ,, 0·045 inch.

This shell, of which I only possess one example, is similar in form and comes nearest to *K. nongsteinensis*, but is very much smaller, the spire less conoid, and much more rounded below. The sculpture is similar to that of *Kaliella*; and I place it at the end of that subgenus until something more is known of the anatomy of these very minute species.

Kaliella ? nongsteinensis, n. sp. (Plate XVI. fig. 2.)

Locality. Maotherichan Peak, 6297 ft., North Khasi (*H. H. G.-A.*).

Shell conical, well rounded below, keeled, subperforate; sculpture very minute, regular transverse ribbing; colour pale ochraceous; spire high, sides convex, apex rounded; suture moderately impressed; whorls 8, closely wound, sides flatly convex; aperture quadrate, narrow, suboblique; peristome thin, columellar margin straight, short, thickened.

Size: major diam. 2·0 mm., alt. axis 1·7 mm.
,, 0·08 inch, ,, 0·07 inch.

I possess only one specimen of this very pretty shaped well-marked shell.

I have named it after that part of the Khasi Hills which is under the "Seem," or chief, of Nongstein.

Kaliella ? tirutana, n. sp. (Plate XVI. fig. 4.)

Locality. North Khasi Hills, three specimens obtained (*H. H. G.-A.*).

Shell globosely conoid, base rounded, solid, keeled; sculpture smooth, with a few indistinct lines of growth; colour bleached; spire conical, sides flat; suture moderately impressed; whorls 6, closely wound, narrow; aperture narrow, rectangular; peristome rather thickened, columellar margin strong, vertical, and a distinct thickening or callus on the lower margin.

Size: major diam. 0·07, alt. axis 0·05 inch.
,, 1·8 ,, 1·3 mm.

For want of a better, I have named this shell after the Demon Tirut, to whom the Khasias so constantly sacrifice and propitiate with offerings.

KALIELLA ? TIRUTANA, n. sp., juv. (Plate XVI. fig. 5.)

Locality. Khasi Hills (*H. H. G.-A.*).

Spire moderately high, conic, sides flat, apex rounded; suture impressed; whorls 6, sides convex: aperture narrow, long, quadrate; peristome thin, but strong and thickened on the columellar margin.

Size: major diam. 0·051, alt. axis 0·034 inch.
,, 1·3 ,, 0·8 mm.

KALIELLA ? CHENNELLI, n. sp. (Plate XVI. fig. 1.)

Locality. Lhota Naga Hills.

Shell depressedly turbinate, much rounded below, sharply keeled, not umbilicated; sculpture very finely ribbed transversely, springing from a well-defined sutural band, smooth below, and apparently slightly and finely hairy when fresh; colour pale horny brown; spire pyramidal, sides flat; suture shallow; whorls $6\frac{1}{4}$, closely wound, regular, sides flat; aperture narrow, elongate; peristome thin, columellar margin perpendicular, rather thickened, sinuate below.

Size: major diam. 3·6 mm., alt. axis 2·0 mm.
,, 0·14 inch, ,, 0·8 inch.

A single specimen only obtained by Mr. A. Chennell, of the Topographical Department, who brought in a number of shells when surveying the above hills, for which I am deeply indebted to him and other members of the Topographical Survey who assisted in surveying the Assam hill-country.

HELIX ? (——?) GLOMEROSA, n. sp. (Plate XIV. fig. 9.)

Locality. Dikrang valley, Dafla Hills (*H. H. G.-A.*).

Shell globular, subperforate; sculpture indistinct, very close longitudinal striæ; colour dull olivaceous; spire conoid, rounded above, sides convex; suture shallow; whorls 6, the last very tumid; aperture narrowly lunate, contracted slightly on the outer margin, a well-marked callus on the body-whorl; peristome strong for size and somewhat thickened below into an indistinct tooth, columellar margin oblique.

Size: major diam. 1·3 mm., alt. axis 0·7 mm.
,, 0·05 inch, ,, 0·03 inch.

This very minute pretty shaped shell is unlike any thing I have found in India; and I place it in the Helicidæ, for its true relationship is very uncertain.

Genus SITALA (*continued from page* 43).

SITALA? BALLIANA, n. sp. (Nev. MS.). (Plate XV. fig. 2.)

Locality. Hills near Ganjam, Madras (*V. Ball*).

Shell umbilicate, carinate, conoid; sculpture, transverse rather irregular fine ribbing or costulation, with four or five strongly marked longitudinal ribs; colour umber-brown, covered with a strong epidermis; spire rather high, conic, sides slightly convex; suture impressed: whorls 5, very convex; aperture semilunate; peristome moderately thickened and slightly reflected near umbilicus.

Size: major diam. 3·6 mm., alt. axis 2·0 mm.
,, 0·14 inch ,, 0·08 inch.

This shell falls close to *S. palmaria* (p. 35, Plate X. fig. 3) in its keeled and conoid form; but it is very much smaller, umbilicated, and the longitudinal ribbing is not so high in relief, being finer and closer.

SITALA UVIDA, n. sp. (Plate XIII. fig. 5.)

Locality. Teria Ghat, south base of Khasi Hills (*H. H. G.-A.*).

Shell narrowly umbilicate, globosely conoid; sculpture wavy, transverse ribbing, crossed by fine indistinct longitudinal lines, which are more distinct on apex, and distant well-marked concentric ribbing on the base; colour pale sienna-brown; spire conoid; suture well impressed; whorls 5, closely wound, convex; aperture ovate, oblique; peristome rather thickened, columellar margin oblique.

Size: major diam. 0·11 inch, alt. axis 0·07 inch.
,, 2·8 mm., ,, 1·7 mm.

Also one from the Jatinga valley, North Cachar Hills.

Somewhat like *S. srimani* (Plate IX. fig. 7): but the form and sculpture distinguish them when the shells are placed side by side, *uvida* being higher in the spire and with much rounder whorls. This species, together with the next, should come in after *tertiana* and *srimani* in the Table given in Part II. page 43.

I defer the continuation of this synopsis of the species until more are figured and described.

SITALA PLACITA, n. sp. (Plate XIV. fig. 3.)

Locality. Khasi, one specimen (type); Munipur, one specimen (*H. H. G.-A.*).

Shell, perforation concealed, globosely conoid; sculpture, distant longitudinal ribbing, on the base far apart and well raised; colour pale horny; spire rather high, conic, apex blunt; suture impressed; whorls $4\frac{1}{2}$, convex, last well rounded on periphery; aperture ovate or nearly semicircular; columellar margin suboblique.

Size: major diam. 2·8 mm., alt. axis 2·0 mm.
,, 0·11 inch, ,, 0·08 inch.

This shell in its form approaches *S. srimani* (Plate IX. fig. 7), but is not so flat on the base.

Sitala subnana, n. sp. (Nevill, MS.). (Plate XIV. fig. 6.)

Locality. Jessore.

Shell conoid, angulate on the periphery, rather flat on the base, perforation hidden; sculpture, finely decussate, regular coarse transverse ribbing, crossed by regular fine longitudinal lines; colour pale sienna-brown; spire conic, sides slightly convex; suture shallow; whorls 4, flatly convex; aperture semilunate; peristome oblique on columellar margin and slightly reflected.

Size: major diam. 0·11 inch, alt. axis 0·06 inch.
 ,, 2·8 mm., ,, 1·5 mm.

This shell has no relationship with *nana*, Hutton, from the N.W. Himalaya. That shell has the distinct transverse fine costulation of *Kaliella* (*vide* Plate V. fig. 6).

Sitala ? crenicincta, n. sp. (Plate XIII. fig. 2.)

Locality. Lailangkote, Khasi Hills (*H. H. G.-A.*).

Shell perforate, depressedly conoid, covered with a thick epidermis, with two parallel rows of fine hairs, pointed under high power; sculpture, transverse irregular ribbing, with regular rather distant continuous longitudinal raised ridges, very distinct on apex, fine concentric ribs on base; colour pale olive-brown; spire low; suture impressed; whorls 4, last rounded; aperture ovately lunate, oblique; peristome thin, columellar margin weak, not reflected.

Size: major diam. 0·09 inch, alt. axis 0·05 inch.
 ,, 2·3 mm., ,, 1·3 mm.

Other localities. Marangsip Peak; Jawai; Teria Ghat; Shillong; Kopamedza Peak, Naga Hills; Munkén valley, Jaintia.

A variety from the wood at Mairang, slightly larger and very narrowly perforate.

Sitala ? intonsa, n. sp. (Plate XIII. figs. 1, 1 *a*, 1 *b*.)

Locality. Marangsip Peak, Khasi Hills (*H. H. G.-A.*).

Shell umbilicate, globosely conical, slightly hirsute; sculpture, irregular ridges of growth, crossed longitudinally with fine and coarser ribbing, a few concentric fine distant ribs on base; colour olive-brown; spire moderately high, obtuse and rounded; suture impressed; whorls 5, sides convex; aperture ovately lunate; peristome thin, very slightly reflected.

Size: major diam. 0·15 inch, alt. axis 0·08 inch.
 ,, 3·8 mm., ,, 2·0 mm.

Sitala ? recondita, n. sp. (Plate XIII. figs. 4, 4 *a*, 4 *b*, 4 *c*.)

Locality. (Type) Raliang, North Jaintia Hills; Jawai near Muntidoo river; Khasi Hills (*H. H. G.-A.*).

Shell depressedly conoid, perforate; sculpture, above regular,

very oblique costulation, on base smooth, but under lens beautifully concentrically and regularly striate, the oblique costulation does not extend to the suture, and each long rib has, above, a short parallel rib adjacent to it (*vide* fig. 4 *c*); colour pale sienna-brown; spire low, apex blunt; suture impressed: whorls 4, regularly increasing; aperture oblique, ovately lunate; peristome thin, columellar margin oblique.

Size: major diam. 0·10–0·12 inch, alt. axis 0·05 inch.
„ 2·5–3·0 mm., „ 1·3–1·6 mm.

Genus Macrochlamys, Benson.

This generic title first occurs, but without description, in the J. A. S. B. vol. i. p. 13, January 1832, in a paper by Benson, who writes:—"Those (*Pterocyclus*, sp.) which I found were, with several specimens of a *Cyclostoma*, a reversed *Carocolla* and *Macrochlamys*;" and in a footnote, "a new genus of the Helicidæ, separated by me from *Helix* in consequence of the wide departure of the animal from the type of that genus;" and the species is indicated, but not then described, from the Gangetic delta, on page 76 of the same volume, for in February 1832 Mr. W. H. Benson presented to the Society a series of the land and freshwater shells of the Doab and of the Gangetic provinces, with a list, in which occurs "*Helix* (*Macrochlamys*) *indicus*, Benson, separated from *Helix* on account of the difference of character in the animal."

The genus is again referred to in vol. v. of same journal, pp. 350, 351 (1836). After describing *Nanina decussata*, Benson says, "On a cursory inspection of this shell I erroneously considered it to be a variety of the species *vitrinoides*, Deshayes, belonging to Mr. Gray's genus *Nanina* (Zool. Proc. July 8, 1834), which I indicated under the name of *Macrochlamys* in the first number of the 'Journal of the Asiatic Society' for January 1832, pp. 13 and 76, and which I altered to that of *Tanychlamys* in a paper on the genus read before the Zoological Society in August 1834. Mr. Gray's characters, drawn up from specimens preserved in spirits and from General Hardwicke's drawings, having the advantage of priority of publication, his name, although inexpressive, will necessarily be adopted. Several independent observers have united in stating the necessity of separating this genus from *Helix* on the characters of the animal; witness the observations of Lieut. Hutton (J. A. S. B. vol. iii. p. 83)."

Again, in 1834, Mr. Benson exhibited a collection of shells from the Gangetic provinces of India, and gave a full description of this genus under the title *Tanychlamys* (altered by the editor to *Nanina*), at the August meeting of the Zoological Society, and recorded in the 'Proceedings,' p. 89, as follows:—

"A collection of Land and Freshwater Shells formed in the Gangetic Provinces of India by W. H. Benson, Esq., of the Bengal Civil Service, and presented by that gentleman to the Society, was exhi-

bited. It comprised forty species, and was accompanied by a descriptive list prepared by the donor, and also by detailed notices of some of the more interesting among them. These notices were read; they are intended by Mr. Benson for publication in the forthcoming number of the 'Zoological Journal.' From the time that he first became acquainted with the animal of a *shell*, resembling in all respects, except in its superior size, the European *Helix lucida*, Drap., Mr. Benson regarded it as the type of a new genus of Helicidæ, intermediate between *Stenopus*, Guild., and *Helicolimax*, Fér. He had prepared a paper on this genus, for which he intended to propose the name of *Tanychlamys*; he finds, however, that Mr. Gray has recently described (p. 58) the same genus under the name of *Nanina*."

The generic characters observed by Mr. Benson are as follows:—

NANINA, Gray.

First original detailed description of shell and animal of *Macrochlamys*:—"*Testa heliciformis, umbilicata; peritremate acuto, non reflexo.*

"*Animal cito repens. Corpus reticulosum, elongatum. Pallium amplum, foramine communi magno perforatum, peritrema amplexans; processubus duobus transverse rugosis (quasi articulatis) omni latere mobilibus instructum, unico prope testæ aperturæ angulum superiorem exoriente, altero apud peripheriam testæ. Os anticum inter tentacula inferiora hians; labia radiato-plicata. Tentacula superiora elongata, punctum percipiens tumore oblongo situm gerentia. Penis prægrandis; antrum cervicis elongatum latere dextro et prope tentacula situm. Solea complanata pedis latera æquans. Cauda tentaculata; tentaculum subretractile glandula ad basin posita humorem viscidum (animale attrectato) exsudante.*"

Mr. Benson describes particularly the habits of the species observed by him, which he first discovered living at Banda, in Bundelkund, on the prone surface of a rock. The animal carries the shell horizontally or nearly so, is quick in its motions, and, like *Helicolimax*, it crawls the faster when disturbed, instead of retracting its tentacles like the Snails in general. In damp weather it is rarely retracted within its shell, the foot being so much swollen by the absorption of moisture that if it is suddenly thrown into boiling water the attempt to withdraw into the shell invariably causes a fracture of the aperture. In dry weather the foot is retracted, and the aperture is then covered by a whitish false operculum similar to that of the other Helicidæ. The two elongated processes of the mantle are continually in motion, and exude a liquid which lubricates the shell, supplying apparently that fine gloss which is observable in all recent specimens. The fluid poured out from the orifice at the base of the caudal horn-like appendage is of a greenish colour; it exudes when the animal is irritated, and at such times the caudal appendage is directed towards the exciting object in such a manner as to give to the animal a threatening aspect.

Of several specimens brought to England by Mr. Benson in 1832 one survived from December 1831, when it was captured in India, until the summer of 1833.

The above description we find published again in the Zool. Journal, 1834, vol. v. p. 458, in a paper entitled "Conchological Notices, chiefly relating to the Land and Freshwater Shells of the Gangetic Provinces of Hindoostan."

Under genus *Nanina*, Gray, and in footnote, we find it stated, "The peculiar form of the animal of this genus had long since induced me to regard it as constituting a distinct group, to which I had in my MSS. assigned the name of *Tanychlamys*; on submitting specimens, however, to the Zoological Society at one of its late meetings I find I have been anticipated by Mr. Gray, who had just previously proposed for it the name which I have adopted above."

He says that it is to be found in the Gangetic plain from Calcutta to Cawnpur, that he found it at Banda, in Bundelkund, that he had received it from the hill-fort of Callingar (Kalingar in north of same district), and also from the old fort at Rigmahal (Rajmahal?); he probably then had not noticed the slight differences in the local forms of this shell.

In July 1834, one month previous to Benson's exhibition of the shells at the August meeting of the Zoological Society, Mr. J. E. Gray had described the genus Nanina, partly from the animals of several species and partly from the animal of a species which had been figured by General Hardwicke in 1797. This figure evidently represents the species common in Calcutta, with the mantle much paler than the rest of the body; and this he erroneously identified as *N. vitrinoides*, Desh., which is a distinct species from the Malay Archipelago, and is *Macrochlamys indica*, Bs.

In the J. A. S. B. pl. iii. p. 83 (Feb. 1832), Hutton describes the Mizapur shell, *M. petrosa*, which he found at Tara, in the low hills near that place, and he gives a good description of the animal of *Macrochlamys* after the No. 3 *Helix*, which, in the list of shells at the end, is recorded as "*H. petrosa* mihi." He says, "dark brown or blackish; body elongate, with a hooked process on the extremity of the tail pointing backwards." He mentions the "two narrow, flat, gradually pointed filaments or tentacula, which, when the animal is in motion, are kept constantly playing over the surface of the shell;" but there is a want of accuracy in the description, for he says they both proceed "from the right side of the animal." To Hutton therefore, and not to Mr. Gray, belongs the credit, among English naturalists, of having first described this genus and noted the great difference between the European and Asiatic forms of *Helix* as then constituted.

But in 1829 Desmoulins had examined and described the animal of an Indian species (*H. lævipes*, Müller), to which he gave the subgeneric title Ariophanta, from its similarity to *Arion* in possessing a mucous pore at the extremity of the foot; and he laid great stress on this anatomical point. Now had *H. lævipes* been a dextral shell, with less marked characters of its own, the title *Ariophanta*

would include all those Indian species with simple neck-lobes and no tongue-like shell-lobes, which have been hitherto placed in *Nanina*. *H. lævipes* is, however, a sinistral form, and related to a group all of this character. I do not myself set much value on it, unless it be supported by others. It is certainly very constant in some genera, but very inconstant in others, not affecting the anatomy in one single point; and it would have made classification much simpler had *Ariophanta* been adopted for all these species until placed in their respective subgeneric positions, restricting it eventually for *lævipes* and its allies; and the subfamily Ariophantinæ would have better distinguished these Asiatic land-shells from the very different and distinct group *Zonites* of Montfort.

Stoliczka adopts the title *Macrochlamys* in the J. A. S. B. 1871, pp. 246, 247, and, after going through the record of it, says, "It is, I think, tolerably clear that under the above name (i. e. *indica*) the Bengal species, usually recorded as *vitrinoides*, was meant. Consequently this species must be taken as the type of *Macrochlamys*, whether it be called *vitrinoides* or *indica*, for both, if different, are no doubt very closely allied."

In the Journ. Asiat. Soc. Beng. for 1881, p. 131, Mr. G. Nevill enters on the question of the priority of *Nanina*, Gray, over that of *Macrochlamys*, Benson, and rather favours the retention of the former in a wide sense, which I think quite unnecessary.

The question of priority is not to be settled by Benson having admitted the validity of Gray's genus over one of his own creation. This an author might do from a modest feeling not to put his own work forward before that of another naturalist; and the editor of the P. Z. S. at the time appears to have substituted Gray's title for Benson's on p. 89, 1834, without reference to previous papers of the latter. This question is to be settled by the writings of the two individuals, and how they can be best interpreted; *i. e.* which of the generic titles is first found in print, and can be best and without any doubt ascribed to a single species also strictly identifiable.

Although Benson in 1832 did not give a detailed description of *Macrochlamys*, yet the species is clearly indicated, and that a genus was necessary to receive it; and this can cause no confusion, for in 1834 he proceeded to publish the same most minutely. Nor should Capt. T. Hutton's writings be overlooked in the chain of evidence; that officer and Mr. Benson worked together, corresponded, and exchanged specimens for years about this period *. We find Hutton describing a closely allied species of this genus in February 1832. It is evident throughout that Benson and Hutton had always the same species in view for the type of the genus *Macrochlamys*, and they knew its characters thoroughly. On the other hand, Gray's knowledge was superficial, he selected no particular type, and his generic description of *Nanina* does not apply rigorously to

* I possess a large number of pamphlets from different journals, sent by Benson to Hutton, with MS. notes and queries in some of them; these were kindly presented to me by the latter when he gave up collecting. What became of Benson's own set and his valuable MS. notes I know not.

the so-called *vitrinoides* of India. Moreover, we find in P. Z. S. 1847, p. 169, in "A List of the Genera of Recent Mollusca, their Synonyma, and Types," *Nanina* and *Macrochlamys* are both subgenera of *Stenopus*, with *citrina* and *vitrinoides* as their respective type shells. *Nanina* should therefore only hold *citrina* and allied forms, apparently a good subgeneric group; but it certainly should not be used in the wide sense that has been given it by so many authors. The family Zonitidæ is sufficient for this; and when all the species of it are collected into well-characterized genera and subgenera there will be no need for any generic term to include the doubtful species of the group. It is even, I think, preferable to use *Helix* in its widest sense than to use *Nanina* for these Asiatic forms. But E. von Martens has condemned the title, and so has Mr. W. T. Blanford; and I cannot do better than quote what the latter writes (J. A. S. B. 1880, p. 184):—"The difficulty is to determine what generic name or names should be adopted. *Nanina* is utterly bad; it offends every law; the name had been used previously by Risso *; the type is the same as that of Benson's genus *Macrochlamys*; the term is objectionable on account of its signification. All this has been pointed out by von Martens †, but still he and others employ the name because it has crept into use. Now in such difficult matters as these generic terms, unless rules are strictly attended to, utter confusion must result, and undoubtedly it has resulted. When, however, a search is made for a better founded term than *Nanina*, endless difficulties are encountered."

In December 1848 Mr. H. E. Strickland, F.G.S., described the animal of another species of this genus, published in the P. Z. S. for that year, p. 142, with two figures (plate xi. figs. 1 and 2); this was obtained in Ajmeer. I give his interesting account in full, for the animal was kept some time alive in this country. He named it *vitrinoides*, following Gray's identification in P. Z. S. 1834.

"*On the Habits of a Living Specimen of* Nanina vitrinoides (*Desh.*). By H. E. Strickland, F.G.S.

"On the 2nd of December, 1847, Capt. W. J. E. Boys presented the writer three specimens of a terrestrial mollusk, named *Nanina vitrinoides* by Mr. Gray (P. Z. S. pt. 2, p. 58, *Helix vitrinoides*, Desh.). Capt. Boys had procured them a considerable time before, certainly not less than a year, in the district of Ajmeer in Upper India. The animals still remained within the shells; but from the length of time during which they had been kept dry, they were greatly reduced in bulk, and had almost wholly retired from the outer volution, as was easily seen from the transparency of the shell. Like many of the Helicidæ of hot climates, especially those which are exposed to long intervals of drought, the *Nanina vitri-*

* "J. A. S. B. 1871, p. 47.

† "Albers, 'Heliceen,' 2. Ausgabe, p. 46, where the synonymy is fully discussed."

noides secretes a calcareous *poma* or deciduous operculum every time that it retires into a state of torpor. The specimens in question had formed two or three successive *pomata*, one within the other, during the process of their desiccation.

"In hopes of restoring their animation, I placed them upon some wet moss in a warm room. Two of them proved to be past recovery, but the animal of the third was seen through the transparent shell to be gradually enlarging in bulk by the absorption of moisture, and at the end of a week it finally reached the door of its dwelling, threw off the *poma*, and began to crawl. A morsel of boiled carrot was presented to it, which it greedily devoured, and speedily increased in health and vigour. I have now kept this interesting creature a twelvemonth, and have often been tempted to exclaim with Oken, 'What majesty is in a creeping snail; what reflection, what earnestness, what timidity, and yet at the same time confidence! surely a snail is an exalted symbol of mind slumbering deeply within itself.' Since its revival my *Nanina* has greatly increased in size, and has added half a volution to its shell, which now measures $\frac{7}{10}$ inch in diameter. Its favourite food is boiled carrots and raw lettuce-leaves. It generally remains quiet during the day, but crawls forth and shows considerable activity in the evening, and has never shown any inclination to hybernate or become torpid for a lengthened period. The shell of *Nanina vitrinoides* is brown, glossy, and pellucid, and in shape and colour closely resembles the shells of the European genus *Zonites*, from which, without examination of the animal, it seems to be generically undistinguishable. The animal, however, is very different, and is more allied to, though quite distinct from, that of the genus *Vitrina*. The foot when contracted is too large to be withdrawn into the shell, except after a considerable period of desiccation. When expanded, and at full stretch, the foot is remarkably long and narrow, measuring about 2 inches in length and $\frac{1}{5}$ inch in breadth. The hinder extremity is abruptly truncate, surmounted by a short horn-like appendage, similar to that in the larvæ of certain Lepidopterous genera.

"But the most peculiar character in the animal of *Nanina* is that of the two elongate pointed lobes or flaps which project from the margin of the mantle, one on each side of the mouth of the shell. These lobes possess a certain amount of lateral motion and a considerable power of retraction and expansion, but are always kept in close contact with the surface of the shell.

"The animal is in the frequent habit of performing the following singular operation, which, as far as I am aware, has not before been noticed in any terrestrial mollusk. Crawling to the top of its prison (which consists of an inverted tumbler, with a small aperture for air), it suspends itself to the glass by the hinder half of the foot, and twists the anterior part round so as to bring its lower surface into contact with the shell. By the great length and flexibility of the anterior half of the foot it is enabled to twist in a variety of directions, and thus to crawl as it were over every part of its own

shell in succession, the hind part of the animal remaining all the while firmly attached to the surface of the glass.

"During this operation the horns are partially contracted, and the mouth of the animal is applied closely to the shell, and is seen to be alternately expanded and contracted, as if in the act of suction. In fact the whole process resembles the action of a cat when licking its feet and body, and is performed with just the same appearance of systematic determination. The object of this operation is no doubt the same in both animals—that of clearing their person from extraneous matter and producing that aspect of cleanliness and beauty which is one of the laws of organic nature in its normal state. Hence that brilliant gloss which distinguishes the shell of the mollusk here referred to. It would be desirable to ascertain whether any analogous habit is possessed by the allied genera *Vitrina* and *Zonites*. The shells of the British species of *Zonites* (*Z. nitens*, *alliacea*, *cellaria*, &c.) closely resemble *Nanina vitrinoides* in form, colour, and glossiness of surface, and their brilliancy must apparently be due to some polishing action similar to that here described. On the other hand it is difficult to understand how the animals of *Zonites* and *Vitrina*, whose foot is much broader and shorter than in *Nanina*, should be able to reach every part of their shell and purify its surface.

"The animal of *Nanina vitrinoides* is of a deep cinereous, the mantle yellowish, its lateral projecting lobes darker; the under surface of the foot pale grey, with a yellowish stripe along each side."

In November 1849 the above gentleman described the same species in the Ann. & Mag. Nat. Hist. The size (diameter $\frac{7}{10}$ inch) and the description of the shell agree well with specimens I have in my collection, collected by the late Capt. A. B. Melville at Jeypur, only 80 miles from Ajmeer, and which I shall describe in the next Part under the title of *Macrochlamys stricklandi*, for it is certainly not the Gangetic delta form.

No group of shells can be more difficult to identify than those that have been classed under this genus. The shells of the larger species are so similar in outward form and texture that they are very liable to be mistaken at a cursory glance; however, considerable differences are to be found when the animals are examined, particularly in the shape and size of the mucous gland at the extremity of the foot, and in the mantle, its lobes, and varying tongue-like lubricating processes.

I have collected species of this genus for many years over a very large area, extending from the Punjab and Mussoorie in the North-west Provinces to Assam on the north-east frontier, and I was early struck with the very great difference in the colour and form of the animal of those shells to which the majority of Indian conchologists then gave the name of *M. vitrinoides*. The shells certainly have a very striking similarity, though on a closer examination differences in the form, the increase of whorls, &c. can be detected. It is not surprising therefore that the whole group stands in a considerable

state of confusion ; and it is to clear this up partially that I have endeavoured to classify them, and distinguish what were the species Hutton, Benson, and others have described and named.

Few of these Indian naturalists had the training and skill to examine the anatomy of the animal; only in a few instances do we find the outward form and colour noticed ; the old plan of boiling and getting rid of the animal as soon as possible was followed, and many species were collected in a dead and bleached state, and were thus described.

I now regret extremely that when I was in India I also was in perfect ignorance of how to dissect a mollusk ; and it was only after association with Henry and William Blanford and Ferd. Stoliczka that my attention was directed to the outward form of the animal, and I recorded this and made many useful sketches from the living animals. Ferd. Stoliczka was one of the first to take up the internal anatomy of the land Mollusca of India; and he published several very interesting and valuable papers in the 'Journal of the Asiatic Society of Bengal,' which I have already referred to.

On commencing with this genus I had to consider what characters I could take or combine to separate on good grounds the very numerous species we have in the East. As the form of mantle is so widely different, and as this organ, however slightly modified, affects the sculpture of the shell, I began to examine under the microscope, and, using a moderately high power, first the sculpture of as many species as I could get access to. In my own collection I have a vast amount of material, all with the exact localities most carefully recorded, and which I knew had never got mixed together. Each box or tube was taken in turn, and every shell separately examined and its sculpture recorded in a tabular form. I soon found that the same species from the same locality were all identical with one another and had a certain defined range, while in many instances the structure and arrangement of the epidermal lines of growth were sufficiently marked to distinguish the species even from a small chip. I give drawings of the most characteristic surfaces, magnified and drawn under the camera lucida. This is of course nothing new in the study of shells, for by far the greater number of species can be distinguished by better and more marked characters, and such labour would be thrown away. I only wish to explain here the method I followed before discrimination was made between the different local forms that came before me. I am under great obligation to Mr. Sylvanus Hanley for a similar examination of his fine collection, to Dr. A. Günther, of the British Museum, and Prof. J. W. Clarke, of Cambridge (where Benson's collection now rests), and to Mr. G. Nevill for specimens from the Indian Museum, Calcutta. Mr. V. Ball also gave me a large number he had collected at different times.

Starting with the sculpture of the shell only as a distinctive character, I first divided these shells into a number of artificial groups, again subdivided roughly by size and form. I only anticipated from the first a remote relationship to be shown ; but it aided greatly in

finding and lumping the species together, and gleaning them eventually out, to be inserted finally in their more natural positions.

The next character I turned my attention to was the odontophore. On going over my own collection I found, not having boiled and removed the animals save of the very large kinds, that in a number of specimens the animal still remained in a hard dried-up state. Placed in water, not only can the mantle-lobes be distinctly made out, but the buccal mass and, what was of equal importance, the reproductive organs and, in several instances, the spermatophores were secured.

I shall give drawings of such parts when describing the different species; although incomplete as a whole, in many cases I think it will be allowed that they are of considerable value specifically, considering how difficult, almost impossible, it will be for many years to collect some of these shells again. I also possessed a few specimens preserved in spirit, which have proved of great use.

The genital organs present us with good specific differences; but, as Stoliczka warns us, they must not be taken as certain evidence, at least not until a very great number of examples have been examined at different stages of growth and at different periods of the year; for it can be easily understood that in a soft animal like a mollusk such organs do undergo very great modification and enlarge at different parts, and that we should expect to find their condition during the period of rest in the cold season different to that during the rains, when they are in their most active state and the process of reproduction going on. These remarks also hold good with respect to the lobes of the mantle, which in moist weather are much more lengthened and expanded. Yet this cannot modify to any great extent the relative position of the different parts or other accessory organs.

Of small size; sculpture smooth; globosely conoid.

Macrochlamys longicauda, n. sp. (Plate XVII. fig. 1.)

Locality. Cherra Poongee (*H. H. G.-A.*).

Shell subglobosely conoid, last whorl rather swollen; no sculpture visible to eye alone, but crossed with very fine raised lines oblique to each other under high power; colour horny brown; spire moderately high, sides rather flat; suture shallow; whorls $5\frac{1}{2}$, sides slightly convex; aperture widely lunate; peristome thin, suboblique near axis.

Size: major diam. 5·6 mm., alt. axis 3·1 mm.
„ 0·22 inch, „ 0·12 inch.

Macrochlamys longicauda, var. (Plate XVII. figs. 2, 2 *a*.)

Locality. Maotherichan Peak, N. Khasi (*H. H. G.-A.*).

Shell globosely turbinate, closely perforate; sculpture none, surface like ground glass; colour pale ochre; whorls $5\frac{1}{2}$, the last subangulate at the periphery; aperture suboblique, narrowly lunate; peristome thin, the columellar margin perpendicular and slightly reflected.

Size: major diam. 4·3 mm., alt. axis 3·1 mm.
,, 0·17 inch, ,, 0·12 inch.

Size of specimen from Maosmai, near Cherra Poongee: major diam. 0·20, alt. axis 0·11 inch.

Other localities: Banks of the Mankén, North Jaintia, and Jawai.

The dried-up animal being apparent in two of the specimens from Cherra Poongee, these were soaked in water for a few days; and I was rewarded by the form of the animal coming out most distinctly, as shown in the drawings made from it, placing it and the allied forms without doubt in this genus. The right shell-lobe is tongue-like, and the small left lobe is present (Plate XX. fig. 1 *b*). The overhanging lobe above the mucous pore at the extremity of the foot (Plate XX. fig. 1) is developed to a great extent: and of this I have the sketch from life in my note-book (fig. 1 *a*)*, together with the following description:—"Animal when fully extended 0·45 to 0·5 inch long. Tentacles of full size; body thin, of a light pale colour, with thin line of dark grey on upper surface to the extremity of the foot; the gland here is large for the size of the animal, and protrudes upwards above the level of the back: in fully developed shells the animal is darker about the head." I also detected the amatorial organ, and the odontophore and jaw are also figured (Plate XX. figs. 1 *c*–1 *e*). The former differs very considerably from that of the typical *Macrochlamys indica* in the smaller number of the median teeth and their elongate form. The laterals have the same bicuspid form; but their number is quite double. Thus in *M. longicauda* the formula is

76 to 80 . 3 . 5 . 1 . 5 . 3 . 76 to 80,
or 84 . 1 . 84,

as against 45 . 1 . 45 in *M. indica*.

The jaw has no central projection, being slightly concave on the cutting-edge.

The central tooth is long with convex sides, and with two small denticles on either side low down near the base; the next five are also long and narrow, with a single small tooth on the outer side; in the sixth and seventh this outer tooth rises and is nearer to the point of the main cusp, and in the eighth and ninth still more so. From the tenth to the outermost all are bicuspid, becoming gradually smaller in size.

Macrochlamys longicauda, var. (Plate XVII. fig. 4.)

Locality. Marangsip Peak, North Cachar Hills (*H. H. G.-A.*).

Shell closely perforate, globosely conoid, rounded below; sculpture none, save a few lines of growth; colour, pale ochraceous epidermis; spire conic, sides flat; suture moderately impressed; whorls 5, sides flatly convex; aperture elongately quadrate; peristome thin, reflected slightly at axis, and subvertical.

* In this character it resembles Semper's genus *Macroceras* from Samar, one of the Philippines; but there is no other similarity.

Size: major diam. 6·4 mm., alt. axis 3·6 mm.
,, 0·25 inch, ,, 0·14 inch.

Not so open at the aperture, and columellar margin straighter and rather more rounded below than in the type.

Macrochlamys nengloensis, n. sp. (Plate XVII. fig. 3.)

Locality. Nenglo, Naga Hills (*H. H. G.-A.*).

Shell perforate, globosely conoid, somewhat flat on the base, slightly subangulate; sculpture smooth, with irregular wavy distant ribbing; colour pale olivaceous green; spire conoid, rather high, sides slightly convex, apex blunt; suture shallow; whorls 6, regularly increasing, flatly convex; aperture narrowly lunate; peristome thin, oblique to axis on columellar margin, and considerably reflected.

Size: major diam. 5·3 mm., alt. axis 3·1 mm.
,, 0·21 inch, ,, 0·12 inch.

This shell is closely allied to *M. longicauda*, but is more globose, with more convexity on the side of the spire; the aperture is narrowly lunate, and the columellar margin is stronger. This shell I considered at first to be the same as *Helix poongee*, Theob., from Moulmain; but a comparison of specimens from that locality in Mr. W. T. Blanford's collection shows the sculpture to be very different, and there is considerable difference in size and form.

Macrochlamys nengloensis, var. (Plate XVII. fig. 5.)

Locality. Munipur (*H. H. G.-A.*).

Shell tumid and rounded below; sculpture none, a few lines of growth, surface like ground glass; colour pale umber-brown; spire conoid; whorls 6; aperture semilunate; peristome thin, oblique near axis, scarcely reflected.

Size: major diam. 5·1 mm., alt. axis 3·1 mm.
,, 0·20 inch, ,, 0·12 inch.

Principally differs in the aperture being wider, a weaker columellar margin, and not so flat on the base.

I obtained a specimen of this species in the Umiam valley near Shillong, which I find described in my note-book as follows:—

"*Sculpture* none, but the epidermis like roughish paper, crossed with microscopic lines irregularly.

"*Animal.* Length 0·33 inch; tentacles nearly 0·1. Dark greyish brown, and ridge of foot of same colour. Foot beneath white. Body long and tapering, with a mucous pore at the extremity of the foot. Shell of a dull pale-brown colour when containing the living animal. By suddenly contracting its body, the animal can throw itself off the position it may be on, after the manner of *Helicarion salius* and other species of that genus.

Macrochlamys koliaensis, n. sp. (Plate XVII. fig. 6.)

Locality. Koliaghur, low hills on Brahmaputra, Nowgong District, Assam (*H. H. G.-A.*).

Shell, perforation concealed, very globosely conoid, rather swollen below, shining, thin; sculpture quite smooth, glassy; colour pale horny; spire conical, apex rather pointed; whorls 6, body-whorl large, close, and regularly wound, suture adpressed; aperture flatly lunate, small; peristome thin, columellar margin oblique.

Size: major diam. 4·1 mm., alt. axis 2·3 mm.
,, 0·16 inch, ,, 0·09 inch.

MACROCHLAMYS ROBERTI, n. sp. (Plate XVII. fig. 7.)

Locality. Angauluo Peak, 6777 ft., Burrail range, Naga Hills (*W. Robert*).

Shell narrowly perforate, globosely conoid, rather flat on basal side, polished; smooth, but transverse lines of growth distinctly marked; colour, pale horny brown epidermis; spire conoid; suture adpressed; whorls $5\frac{1}{2}$, the last flattened below; aperture lunate; peristome thin, oblique and slightly reflected near umbilicus.

Size: major diam. 4·1 mm., alt. axis 2·0 mm.
,, 0·16 inch, ,, 0·08 inch.

I name this after one of my assistant surveyors, Mr. W. Robert, who has collected extensively and so successfully for me.

MACROCHLAMYS DORANI, n. sp. (Plate XVII. fig. 8.)

Locality. Maotherichan Peak, N. Khasi (*H. H. G.-A.*).

Shell closely umbilicated, globosely conoid; sculpture quite smooth, with an indication of ribbing; colour pale umber-brown; spire low, blunt; whorls 5, rounded, the first the largest and swollen; aperture ovately lunate; peristome thin.

Size: major diam. 3·3 mm., alt. axis 2·3 mm.
,, 0·13 inch, ,, 0·09 inch.

A form very close to *M. umbraticola*, though much smaller, more globose, and with a less expanded aperture.

MACROCHLAMYS TANIRENSIS, n. sp. (Plate XVII. fig. 9.)

Locality. Tanir Peak, 4400 ft., Dafla Hills (*H. H. G.-A.*).

Shell, perforation concealed, globosely conoid, body-whorl large; sculpture polished, quite smooth; colour pale sienna-brown; spire depressedly conoid, apex rounded; whorls $4\frac{1}{2}$, regularly increasing, sides slightly convex; aperture vertical, lunate; peristome thin, columellar margin oblique.

Size: major diam. 2·8 mm., alt. axis 1·5 mm.
,, 0·11 inch, ,, 0·06 inch.

Two specimens only from above locality. One in Indian Museum, Calcutta.

MACROCHLAMYS RUSTICULA, n. sp. (Plate XVII. fig. 10.)

Locality. North Khasi (*H. H. G.-A.*).

Shell minute, very narrowly umbilicated, depressedly conoid, rather solid, shining, subangular; sculpture quite smooth; colour sienna-brown; spire rather flat; whorls 4; aperture subvertical, widely lunate; peristome thickened and very oblique on columellar margin.

Size: major diam. 2·3 mm., alt. axis 1·0 mm.
,, 0·09 inch, ,, 0·04 inch.

Macrochlamys ? planiuscula, Hutton. (Plate XVI. figs. 7, 7 *a*.)

Helix planiuscula, J. A. S. B. March 1838, p. 218; Conch. Ind. p. 15, pl. xxxii. figs. 7–10.

Macrochlamys, sec. D, Theob. Cat. p. 19.

Original description:—"*Testa parvula, depressa, fusca, polita; anfractibus quinque, ultimi peripheria rotundata; apertura transversa.*

"Diam. 0·1.

"Found at Simla on dead leaves.

"This shell is darker and smaller than *H. crystallina* of Britain, which has likewise a more flattened apex than the Simla species." (*B.*) *Helix crystallina*, however, belongs to *Zonites* or *Hyalina*, Fér., and is not related to this species.

There is no authority for placing this shell in the genus *Macrochlamys*, and I do so with considerable doubt; it must take a position at the end of that genus until we know what the animal is like. I found it pretty abundant in the ravines at Mussoorie among dead leaves; the specimen figured is from that place.

Size: major diam. 3·3 mm., alt. axis 1·7 mm., of specimen figured.

Macrochlamys ? darjilingensis, Nevill, MS., n. sp. (Plate XVII. fig. 11.)

Locality. Darjiling (*Col. Mainwaring*).

Shell, perforation hidden, depressedly globose, solid, shining; surface smooth, with rather regular distant transverse faint ribs; colour pale horny white; apex flatly rounded; suture adpressed, shallow; whorls 5, closely wound; aperture perpendicular, narrowly lunate, with a thin callus on the body-whorl; peristome rather thickened, scarcely reflected at the short columellar margin.

Size: major diam. 1·7 mm., alt. axis 0·9 mm.
,, 0·07 inch, ,, 0·04 inch.

Of this distinct and peculiar little shell four specimens were sent me by Mr. G. Nevill. It is difficult to know where to place it; and it may possibly be a true *Helix*.

Macrochlamys ? molecula, Bs. (Plate XVI. fig. 8.)

Helix molecula, Benson, Ann. & Mag. N. H. 1859, iii. p. 389; Pfr. Mon. Hel. vol. v. p. 69; Conch. Ind. pl. xxxii. figs. 8, 9, p. 15.

Macrochlamys, sec. E, Theob. Supp. Cat. p. 20.

Nanina (*Microcystis*), Nev. Hand-list, p. 38. no. 162.

Locality. Rangoon (*Stoliczka*).

Size of specimen figured: major diam. 4·4 mm., alt. axis 1·9 mm.
,, 0·17 inch, ,, 0·08 inch.

Original description:—"*Testa anguste perforata, conoideo-globosa, tenui, obsolete radiato-striata, nitida, fusco- vel castaneo-cornea; spira conoidea, lateribus convexiusculis, sutura impressa, submarginata,*

apice obtuso; anfractibus $5\frac{1}{2}$ arcte convolutis, convexiusculis, ultimo ad peripheriam rotundato, subtus convexo; apertura vix obliqua, late lunari, peristomate recto, acuto, margine columellari anguste reflexo.

"Diam. major vix 5, minor 4, axis 3 mill.

"Habitat ad Rangoon, satis copiose.

"A minute shell, with a more conoid spire and more closely wound whorls than *H. causia.* It is altogether deficient in the spiral striæ which distinguish that species."

Fine, longitudinally striate sculpture; globosely conoid.

Macrochlamys umbraticola, n. sp. (Plate XIV. figs. 4, 4 *a.*)

Locality. Hengdan Peak, North Cachar Hills (*H. H. G.-A.*).

Shell, perforation concealed, globosely conoid; sculpture very minute, regular, longitudinal striæ; colour pale olive-brown; spire low; whorls $4\frac{1}{2}$; aperture ovately lunate, suboblique; peristome rather thickened, very slightly reflected.

Size: major diam. 0·17 inch, alt. axis 0·08 inch.
,, 4·3 mm., ,, 2·2 mm.

This shell was very abundant among the dead leaves in the forest around the above-mentioned peak; I also got single specimens in the Jatinga valley and Kopamedza Peak, 8376 ft., in the Naga Hills.

Macrochlamys perpaula, Bs. (Plate XIV. fig. 5.)

Helix perpaula, Bs. Ann. & Mag. Nat. Hist. 1859, iii. p. 390; Pfr. Mon. Hel. vol. v. p. 69; Conch. Ind. p. viii (not figured).

Nanina (*Microcystis*), Nevill's Hand-list, p. 37. no. 156.

Locality. Moulmain (*Stoliczka*).

Shell perforate, rounded below, glassy; sculpture, regular longitudinal fine ribbing throughout, crossed by evenly disposed lines of growth, but not decussate; colour umber-brown; spire conoid, apex rounded; whorls 4, much rounded; aperture lunate.

Size: major diam. 0·09 inch, alt. axis 0·05 inch.
,, 2·3 mm., ,, 1·3 mm.

Original description:—"*Testa perforata, depresso-globosa, oblique striatula, sub epidermide cornea albida; spira conoideo-convexa, apice obtuso, sutura impressa; anfractibus $4\frac{1}{2}$ sensim crescentibus, convexiusculis, ultimo rotundato, subtus convexo; apertura obliqua, rotundato-lunari, peristomate recto, acuto, margine columellari reflexo, suboblique descendente, basali arcuato.*

"Diam. major 2, minor $1\frac{2}{3}$, axis $1\frac{1}{3}$ mill.

"Habitat ad Phie Thán, raro.

"Allied to *H. molecula*, but, besides its much smaller size, it is more globose. The single specimen received is much weathered. It is probably translucent and polished when fresh. The spire is less conoid, and the whorls not so closely wound as in *H. bullula*, Hutton, of the Western Himalaya.".

Nevill gives (*l. c.* p. 37) Parisnath and Darjiling as localities where this shell has been found. These specimens should be again closely compared with typical examples.

Macrochlamys? kandiensis, Nev. MS., n. sp. (Plate XIV. fig. 2.)

Locality. Kandy, Ceylon.

Shell perforate, globosely conoid; sculpture fine, regular, rather distant, longitudinal striæ or grooving, the surface of the shell much decomposed in patches, giving it a mottled appearance; colour dark chestnut-brown; spire subdepressedly conoid, sides rather rounded; suture well marked; whorls 5, the last well rounded; aperture oblique, ovately lunate; peristome thin, slightly reflected on the columellar side.

Size: major diam. 0·16 inch, alt. axis 0·09 inch.
,, 4·1 mm., ,, 2·3 mm.

Nevill remarks that it is near *M. stephoides*, Stol., from Penang Hill; but it has a very different form from the figure 9 in the J. A. S. B. 1873, pl. 1.

Macrochlamys poongee, Theobald. (Plate XIV. fig. 1.)

Macrochlamys poongee, Theob. J. A. S. B. 1859, vol. xxviii. p. 307.

Helix poongee, Conch. Ind. pl. xvi. fig. 9, p. 8 (gives the idea of a shell with a thickened peristome).

Macrochlamys poongi (sec. D), Theob. Supp. Cat. p. 19.

Nanina (*Microcystis*) *poongee*, Nev. Hand-list, p. 38. no. 159.

Locality. Moulmain (*Stoliczka*).

Sculpture microscopic, close, longitudinal striation, hardly visible on the apical whorls; colour rich brown.

Original description:—" *Testa turbinate conoidea, tenui, apice depressiusculo, anguste umbilicata, tumida, fusco-cornea; anfract.* $6\frac{1}{2}$ *convexis; apertura rotunde lunari; perist. recto, acuto.*

" Diam. 0·26, alt. 0·20 inch. A thin brown *Helix*, somewhat resembling the small *H. molecula*, but with a more elevated spire, which, however, varies a little in different species."

Size: major diam. 5·4 mm., alt. axis 3·8 mm.
,, 0·21 inch, ,, 0·15 inch.

Nevill gives also Cherra Poongee and Naga Hills as the habitat of this species, from specimens sent by Mr. Chennell and myself to the Calcutta Museum: these are *M. longicauda* and *M. nengloensis* of my collection, which originally were considered to be *H. poongee.* The sculpture and colour are quite distinct.

Macrochlamys pacata, n. sp. (Plate XIV. fig. 10.)

Locality. Lhota Naga Hills (*A. Chennell*).

Shell depressedly conoid, thin, smooth, and glassy; sculpture fine regular and somewhat distant lines of longitudinal striæ; colour sienna-brown; spire low, rather flat; suture adpressed; whorls $4\frac{1}{4}$, last largest and tumid below, regularly increasing; aperture ovately lunate; peristome thin, columellar margin perpendicular and reflected.

Not fully grown.

Size: major diam. 0·11 inch, alt. axis 0·05 inch.
,, 2·8 mm., ,, 1·3 mm.

Macrochlamys faceta, n. sp. (Plate XIV. fig. 7.)

Locality. Dikrang valley, Dafla Hills (*H. H. G.-A.*).

Shell globosely conoid, scarcely perforate; sculpture fine, close, regular longitudinal furrowing; colour ochraceous; spire subconoid, sides flat; suture adpressed; whorls 4, convex, the last tumid; aperture subvertical, ovately lunate; peristome thin, columella weak, subvertical.

Size: major diam. 2·7 mm., alt. axis 1·4 mm.
   ,, 0·11 inch, ,, 0·06 inch.

This shell is somewhat of the form of *umbraticola*, but is much smaller and the whorls not so rounded and globose as in that shell.

MACROCHLAMYS ENATA, n. sp. (Plate XIV. fig. 11.)

Locality. Lhota Naga Hills (*Chennell*).

Shell globosely conoid, thin, transparent; sculpture fine, very regular longitudinal striæ, glassy to the eye alone; colour pale sienna-brown; spire moderately high, conic, blunt; suture shallow; whorls $4\frac{1}{2}$, regularly increasing; aperture oval, subvertical; peristome thin, perpendicular at the columellar margin.

Size: major diam. 2·4 mm., alt. axis 1·1 mm.
   ,, 0·10 inch, ,, 0·04 inch.

MACROCHLAMYS ORIGINARIA, n. sp. (Plate XIV. fig. 12.)

Locality. Munipur (*H. H. G.-A.*).

Shell perforate, globosely conoid, glassy, rather solid, and rounded below; sculpture fine regular longitudinal striation; colour sienna-brown; spire moderately conoid, the side convex; suture shallow; whorls $4\frac{1}{2}$, the last with a tendency to subangulation; aperture ovate, subvertical; peristome thin, suboblique.

Size: major diam. 2·5 mm., alt. axis 1·5 mm.
   ,, 0·10 inch, ,, 0·06 inch.

MACROCHLAMYS SATA, n. sp. (Plate XIV. fig. 13.)

Locality. Shenghor Peak, 6706 feet, Dafla Hills (*coll. Indian Museum*), one specimen; Toruputu Peak, 7322 feet, Dafla Hills, one specimen (*H. H. G.-A.*).

Shell depressedly conoid, very small; sculpture microscopic regular lines of striæ, crossed transversely with other striation; colour pale olivaceous grey, mottled black, with shining lustre; spire flat; suture impressed; whorls 4, sides flatly convex; aperture lunate; peristome oblique below from columellar margin.

Size: major diam. 2·0 mm., alt. axis 0·8 mm.
   ,, 0·08 inch, ,, 0·03 inch.

MACROCHLAMYS? ANONÆ, n. sp. (Plate XIV. fig. 8.)

Nanina (*Microcystis*), n. sp., Nev. Hand-list, p. 38. no. 163 (found on fruits of the custard-apple).

Locality. Calcutta (*G. Nevill and J. Wood-Mason*).

Shell narrowly perforate, subdepressedly conoid, covered with a rough limy deposit; sculpture indistinct longitudinal fine ribbing,

with a few transverse ridges of growth; colour umber-brown; spire subconoid, sides flat; suture shallow; whorls 4, the last rounded below and somewhat compressed towards the aperture; aperture oblique, laterally lunate; peristome somewhat thickened, oblique on columellar margin.

Size: major diam. 0·06 inch, alt. axis 0·03 inch.
,, 1·5 mm., ,, 0·08 mm.

This very minute species, the generic position of which is very uncertain, and which it would be interesting to examine in a living state, I place in the above genus with doubt. It was sent me by Mr. G. Nevill, with the title ?*peliosanthi*, Mörch; but the description does not agree.

Helix (*Kaliella*) *peliosanthi*, Mörch, Videnskabelige Meddelelser, 1872, p. 13.

Original description:—"*T. minutissima, trochiformis, obtecte perforata; anfr.* $4\frac{1}{2}$, *medio angulati, spiraliter lineati; lineæ incrementi expressæ, regulariter remotæ; anfr. ultimus bicarinatus, basi plana nitida, umbilico anguste obliquo. Epidermis tenuissima, in carinis ciliata. Apertura rhombea, columella subdentata.*

"Diam. $1\frac{1}{10}$ mm., alt. $1\frac{1}{5}$ mm.

"Paa Bladene af *Peliosanthes teta* fra Haven i Calcutta. (*Dr. Didrichsen*). Maa være nærmest beslægtet med *Nanina* (*Kaliella*) *conulus*, Blanford (Contrib., Pfr. Mgr. v. p. 90) men de to kjöle ere forsynede med meget grove Cilier, og undersiden er aldeles flad; ligeledes er den nye Art meget mindre."

I hope to obtain this from Copenhagen, and give a figure of it.

EXPLANATION OF PLATE XIII.

Fig. 1, 1 *a*. *Sitala intonsa*, G.-A., × 7. Khasi Hills.
1 *b*. Ditto: sculpture, × 50.
2. *Sitala crenicincta*, G.-A., × 12. Khasi Hills.
3. Ditto, × 7.
4, 4 *a*, 4 *b*. *Sitala recondita*, G.-A., × 7. Raliang, Jaintia Hills.
4 *c*. Ditto: sculpture, much enlarged.
5. *Sitala uvida*, G.-A., × 7. Teria Ghat, Khasi Hills.
6. —— ? *nevilli*, G.-A., × 4. Darjiling.

EXPLANATION OF PLATE XIV.

Fig. 1. *Macrochlamys poongee*, Theobald, × 4. Moulmain, Tenasserim.
2. —— ? *kandiensis*, Nevill, MS., × 7. Kandy, Ceylon.
3. *Sitala placita*, G.-A., × 12. Khasi and Munipur.
4. *Macrochlamys umbraticola*, G.-A., × 7. North Cachar Hills.
4 *a*. Ditto: sculpture, × 50.
5. *Macrochlamys perpaula*, Benson, × 7. Moulmain, Tenasserim.
6. *Sitala subnana*, Nevill, MS., × 8. Jessore.
7. *Macrochlamys faceta*, G.-A., × 12. Dafla Hills.
8. —— ? *anonæ*, G.-A., × 12. Calcutta.
9. *Helix* ? (—— ?) *glomerosa*, G.-A., × 20. Dafla Hills.
10. *Macrochlamys pacata*, G.-A., × 8. Lhota Naga Hills.
11. —— *enata*, G.-A., × 8. Lhota Naga Hills.
12. —— *originaria*, G.-A., × 8. Munipur.
13. —— *sata*, G.-A., × 8. Dafla Hills.

EXPLANATION OF PLATE XV.

Fig. 1. *Kaliella lailangkotensis*, G.-A., × 7. Khasi Hills.
1 *a*. Ditto: sculpture, × 50.
2. *Sitala balliana*, Nev. MS., × 7. Ganjam.
3, 3 *a*. *Kaliella kezamahensis*, G.-A., × 8. Naga Hills.
4, 4 *a*. —— *ruga*, G.-A., × 8. Naga Hills.
5, 5 *a*. —— *burrailensis*, G.-A., × 7. Naga Hills.
5 *b*. Ditto: sculpture, × 50.
6, 6*a*. *Kaliella conulus*, W. T. Blf., × 12 and 8. North Cachar.

EXPLANATION OF PLATE XVI.

Fig. 1. *Kaliella? chennelli*, G.-A., × 7. Lhota Naga Hills.
1 *a*. Ditto, suture between first and second whorls.
2. *Kaliella nongsteinensis*, G.-A., × 12. North Khasi Hills.
3. —— *dikrangensis*, G.-A., × 20. Dafla Hills.
4. —— *tirutana*, G.-A., × 24. North Khasi.
5. Ditto, juv., × 24. North Khasi.
6. *Kaliella leithiana*, G.-A., × 7. Ceylon.
6 *a*. Ditto: umbilical region, × 12.
6 *b*. Ditto: the keel of the last whorl, much enlarged.
7, 7 *a*. *Macrochlamys? planiuscula*, Hutt., × 9. N.W. Himalaya.
8. ——? *molecula*, Bs., × 7. Rangoon, Pegu.

EXPLANATION OF PLATE XVII.

Fig. 1. *Macrochlamys longicauda*, G.-A., × 8. Khasi Hills.
2, 2 *a*. Ditto, var., × 8. Khasi Hills.
3. *Macrochlamys nengloensis*, G.-A., × 8. Naga Hills.
4. —— *longicauda*, var., × 7. S. Jaintia Hills.
5. —— *nengloensis*, var., × 8. Munipur.
6. —— *koliaensis*, G.-A., × 7. Assam.
7. —— *roberti*, G.-A., × 8. Burrail range.
8. —— *dorani*, G.-A., × 8. Khasi Hills.
9. —— *tanirensis*, G.-A., × 8. Dafla Hills.
10. —— *rusticula*, G.-A., × 12. North Khasi Hills.
11. —— (?) *darjilingensis*, Nevill, MS., × 20. Darjiling.

EXPLANATION OF PLATE XVIII.

Fig. 1. *Macrochlamys indica*, Bs., nat. size. Calcutta. Showing position of the right shell-lobe in life, somewhat contracted.
2. Ditto, spirit-specimen: view of right side, × 4, showing:—*r.s.l.*, right shell-lobe; *r.d.l.*, *l.d.l.*, right dorsal lobe and left dorsal lobe.
3. Ditto, ditto: left side, with left shell-lobe (*l.s.l.*) and posterior termination of the left dorsal lobe (*l.d.l.*).
4. Ditto: sketch of end of the foot, from life, somewhat enlarged.
5, 5 *a*. Ditto, shell of, × 2·4.
6. Ditto: generative organs, × 4: *h.d.*, hermaph. duct; *Al. Gd.*, albumen-gland; *o.v.*, oviduct; *P.*, penis; *c.r.P.*, cæcum of retractor muscle of the penis; *c.d.*, cæcum calciferum, or kalk-sac; *D*, the amatorial organ.
7. Ditto: jaw, × 20.
8, 8 *a*, 8 *b*. Portion of the radula, × 360; central, median, and lateral teeth.

EXPLANATION OF PLATE XIX.

Fig. 1, 1*a*. *Macrochlamys petrosa*, Hutton. Bhangulpur.
2. —— *tugurium*, Bs. Darjiling.
3, 3*a*. —— *sikrigulliensis*?, Nevill. Calcutta.
4. —— *perplana*, Nevill. Parisnath.
5. —— *lecythis*, Bs.? Parisnath.
6, 6*a*. —— *decussata*, Bs., *in coitu*, and to show the shell-lobes. Cherra Poongee.
7. *Macrochlamys honesta*, Gould: *r.s.l.*, *l.s.l.*, right and left shell-lobes; *r.d.l.*, *l.d.l.*, right and left dorsal lobes. Mulé-it range, Tenasserim.
7*a*. Ditto: extremity of foot, from spirit-specimen.
7*b*. Ditto: jaw, ditto.

These species will be described in detail in Part IV. Figures 1–5 are from drawings by a native artist, executed under the superintendence of Ferd. Stoliczka, and preserved in the Indian Museum Library, Calcutta.

EXPLANATION OF PLATE XX.

Fig. 1. *Macrochlamys longicauda*, G.-A.: the extremity of foot, from spirit-specimen, × 12.
1*a*. Ditto: the extremity of foot, showing the long lobe over the mucous gland. Drawn from life.
1*b*. Ditto: the mantle, from spirit-specimen, × 12.
1*c*. Ditto: jaw, × 20.
1*d*. The odontophore, central and median teeth, × 720.
1*e*. Outermost laterals, × 720.
2. *Macrochlamys lailangkotensis*, G.-A., jaw of, × 50.
2*a*. Ditto: central and median teeth up to the 7th, and 8th, 9th, and 10th laterals; 2*b*, 11th, 12th, and 13th laterals; 2*c*, the outermost laterals, × 720.
3. *Macrochlamys tugurium*, Benson, showing the shell- and mantle-lobes: lettering as above. *Res.or.*, respiratory orifice. In 3, 3*a*, the *l.s.l.* would turn backwards over the edge of the shell.

EXPLANATION OF PLATE XXI.

Sculpture of portion of last whorl near aperture, × 50; viewed from above, the aperture directed towards the bottom of the diagram.

Fig. 1. *Macrochlamys indica*, Bs. Calcutta.
2. —— *petrosa*, Hutton. Rajmahal.
3. —— *splendens*, Hutton. Mussoorie.
4. ——, near *lubrica*, Bs. Dafla Hills.
5. ——, species undetermined. Lhota Naga.
6. —— *daflaensis*, G.-A. Dafla Hills, Assam.
7. —— *castaneo-labiata*, G.-A. Naga Hills.
8. —— *masuriensis*, G.-A. N.W. Himalaya.
9. —— *sylhetensis*, G.-A. Chatak.
10. —— *hardwickii*, G.-A. Calcutta.
11. *Bensonia monticola*, Hutton, juv. Mussoorie.
12. —— ditto, = *labiata*, Pfr. Mussoorie.
13, 13*a*. *Macrochlamys*? *pedina*, Benson: first and second whorls. Bombay.
14. —— *staffordi*, G.-A.: ditto. Dafla Hills.
15. —— *decussata*, Bs. Khasi Hills.
16. —— *longicauda*, G.-A. Khasi Hills.
17. —— ? *textrina*, Bs. Pegu.

LAND AND FRESHWATER MOLLUSCA

OF

INDIA.

Part IV.—OCTOBER 1883.

(Plates XXII.-XLII.)

Having given in Part III. the history and original descriptions of Benson's Genus *Macrochlamys* and denoted the type *M. indica*, I shall commence this Part with a detailed description of that species and its anatomy, together with some other allied forms, and show what modifications and divergences they present.

Stoliczka, when treating of this genus in the J. A. S. B. 1871, p. 246, considers *M. indica*, Bs., of Calcutta, to be the type, for similar reasons as I have given. Professor C. Semper's work is referred to, which leaves no doubt but that the species the latter received from Dr. J. Anderson and described was a true *Macrochlamys* from Darjiling, but not *splendens* of the N.W. Himalaya, which, from what I can remember of the animal, is a very distinct and different form. Stoliczka, unfortunately, instead of taking one of the Calcutta species for his detailed description of the genus, selected *M. honesta*, so different—he says (p. 250) he could not detect the kalc-sac—that to it he attaches a subgeneric value, being led to do so by observing the presence of the peculiar spermatophore, which he had not then made out to be that organ. Taking this character and the large lobes of the mantle, he considered Blanford's *Durgella* its probable subgeneric position; he says:—"This name has been proposed for Benson's *Helix levicula* from Tenasserim as type, and would indicate a close relation, both in the form of the shell and the characters of the animal, to *Helicarion*." I have since shown, when describing the animal of *Durgella levicula* (Proc. Linn. Soc., Zool. xv. p. 291), how very distinct and how far removed it is in every way from the genus under review and *Helicarion, i. e.* the Indian forms of this genus. The absence of an amatorial organ in the specimens of *M. honesta* dissected by Stoliczka is a departure from the typical form of *Macrochlamys*; and I shall treat of this point when describing that species. To show to what extent the true *Helicarion* of Australia differs from our Indian forms I give a Plate of a species kindly sent me from Sydney by Dr. T. Cox, for which I am greatly indebted to him.

There are certainly three species in Calcutta that have been included under *M. vitrinoides*. Stoliczka alludes to two (J. A. S. B. 1871, p. 246) in these words:—"There occur two allied

forms of the *vitrinoides* type about Calcutta, one very flat with the base conspicuously concave about the umbilicus" (this I believe to be the same as the species from Cachar [Plate XXVII. fig. 2]); "it is very closely allied to *M. lubrica*, Bens. The other is a little higher and is said to be *vitrinoides*, Desh. Both are thin shells: the former appears to have no trace of spiral striation; in the other the striæ become traceable when the superficial glossy polish is weathered off, but even then they are not nearly so strongly marked as in *splendens*" (*vide* Plate XXI. fig. 3). Stoliczka was therefore not making a comparison with such distinctive sculpture as that shown on Plate XXI. figs. 9 and 10. He continues, "Neither of these Calcutta species agrees sufficiently with the original description of Deshayes's *Helix vitrinoides*; but there have been so many other allied species (*pedina*, *decussata*, *sequax*, *resplendens*, &c., and lately one or two by Semper and Martens) described, that it would be unsafe to augment the already confused literature with new names without previously most carefully comparing all the allied forms. Among all the Indian Zonitidæ the species of the *vitrinoides* type are certainly the most difficult of discrimination." It is the second species alluded to, with sculpture like *M. splendens*, that I consider to be *M. indica* (Plate XVIII.), for its sculpture has the same arrangement of the spiral striæ as in *M. petrosa* (Plate XXI. figs. 1 and 2), a closely allied variety.

Mr. Gray, when describing his genus *Nanina*, in which he included a *H. vitrinoides*, mentions Major-General Hardwicke's drawing made in 1797; and he must have written his description of the animal partly from this drawing. In his 'Catalogue of the Pulmonifera in the British Museum,' p. 73, although he makes *H. citrina* the type of the above genus, in the description and synonymy of *H. vitrinoides*, p. 81, we find the P. Z. S. of 1834, p. 58, quoted, and with it a reference to Mrs. Gray's 'Figures of Molluscous Animals,' vol. iv. p. 111, t. 71. f. 5, for the animal. I have lately looked at the interesting original drawings at the British Museum, many of them signed Eliza Hardwicke. There are two distinct species of *Macrochlamys* given, Nos. 10 and 11; the first bears the date Futtehgurh, Aug. 1797, the second Dumdum, Oct. 1823; this last was the one copied into Mrs. Gray's work, so that both have received the same specific title. As Hardwicke's drawings constitute the first and original record of the genus *Macrochlamys* I give a description of them.

No. 10. Macrochlamys petrosa, ? Hutton.

A very black-coloured species; body long, the lobe over the mucous gland very tapering and pointed. The right shell-lobe very narrow and long, and extending over the shell; the left shell-lobe also long and well developed. Shell of 5 whorls; colour ruddy brown. Major diam. 18·5 mm. = 0·73 inch.

Futtehgurh, which is not far from Banda, typical locality of *petrosa*.

No. 11. MACROCHLAMYS INDICA, ? Benson.

Animal of a light purplish tint, the tail-lobe not lengthened, slightly overhanging. The right shell-lobe broadly triangular and extending to the apex. No left shell-lobe shown. Shell, whorls $4\frac{1}{2}$; colour ochre-brown. Major diam. 21·0 mm. = 0·83 inch.

Dumdum, near Calcutta.

It is unfortunate that no accurate drawings were made of these two species, showing the shells in different positions; both are represented viewed from above, so that we cannot identify them with absolute certainty. No. 10, however, in its shell-lobes agrees best with *M. petrosa* (*vide* Plate XIX. fig. 1), and in its coloration with Hutton's description, and No. 11 agrees best with *M. indica*.

The third species from the neighbourhood of Calcutta is one which I have found in Assam and Cachar, and may be known at once by its sculpture (Plate XXI. figs. 9 & 10) from the other two. This I describe and name *M. hardwickei*, after General Hardwicke. Mr. G. Nevill, in the J. A. S. B. 1881, p. 132, founds a new species, *M. pseudovitrinoides*, on *M. indica* of Benson and the *H. vitrinoides*, Gray (thus identified), the animal of which was described by Strickland in the P. Z. S. 1849 and figured on plate 2. Nevill gives no description; he merely says "it is the common snail" throughout the plains of the Gangetic delta, and that he is indebted for a fine series of this species from Sylhet to Mr. J. Wood-Mason. It is quite impossible from this sort of data supplied with the first notice of a new species to know what was received, when we know there are three or four common snails of this type in the above delta, each equally abundant in *different* localities. There is no proof, in fact, that the Ajmeer form is the same as *indica* of Benson; and it is more than doubtful if the Ajmeer species is to be found in Sylhet.

The accession of many thousand specimens in all the local genera preserved in spirit, for which magnificent collection I am indebted to the industry of Mr. Wm. Robert, of the Survey Department, who collected them in the Bhutan Mountains east of the Teesta, from their base to 10,000 feet, enables me to give drawings and descriptions of several species I had not got before, and renders the history of the present genus more complete.

Passing from *Macrochlamys* to *Austenia*, Nevill, I find also in this last genus species with perfectly smooth shells, and others with delicate well-marked sculpture. I figure these on separate plates as a simple guide for identification, although, as shown in *Macrochlamys*, the sculpture has but a slight connexion with anatomical detail.

MACROCHLAMYS (*continued*).

Shells of large size, globose or depressedly globose; sculpture, *longitudinal, linear, rather wavy striation, with smooth ribbon-like intervals.* (*Vide* Plate XXI. figs. 1, 2, 3, and 4.)

MACROCHLAMYS INDICA, Benson. (Plate XVIII. figs. 5, 5 *a*.)

Macrochlamys indica, Benson, J. A. S. B. vol. i. p. 13 (1832).

Locality. Calcutta.

Shell very depressedly conoid, base flat, thin, translucent, shiny; sculpture longitudinal, the bands rather waved, the transverse lines of growth not very distinct (Plate XXI. fig. 1); colour pale umber-brown; spire low, sides flat, apex convex; whorls $5\frac{1}{2}$, regularly increasing, flat above, the last rounded; aperture subvertical, subglobosely lunate; peristome thin, straight, the columellar margin obliquely descending.

Size: maj. diam. 17·0, min. 14·8; alt. axis 6·3, body-whorl 5·8 mm.
„ 0·67, „ 0·58; „ 0·25, „ 0·23 inch.

Two other specimens:—

Maj. diam. 18·7,	min. 16·3;	alt. axis 8·3,	body-whorl 6·7 mm.
„ 0·74,	„ 0·64;	„ 0·33,	„ 0·26 inch.
„ 19·8,	„ 18·0;	„ 8·75,	„ 6·78 mm.
„ 0·76,	„ 0·71;	„ 0·35,	„ 0·27 inch.

The mantle (Plate XVII. fig. 2, and Plate XXV. figs. 9, 10). The right shell-lobe small, the left is narrowly reflected over the edge of the peristome, and at the basal side gives off a short tongue-like process; the right dorsal lobe is narrow, elongate, and extends to the columellar margin near the great retractor muscles; the left dorsal lobe has two distinct positions, as viewed from the outside (Plate XXV. fig. 10), an anterior and a posterior, but when turned back and viewed from below (fig. 9) they are seen to be united by a reentering concavity in the margin, which is not so free as the above portions on either side—an approach to the more distinct separation of the two portions which we find in *M. atricolor* and other species (*vide* Plate XXV. fig. 8).

Generative organs. At the junction of the vas deferens a moderately long, cylindrical, blunt kalc-sac is given off a short flagellum; it is then straight for a short distance, forms a sharp twist, and is continuous again, but before reaching the retractor-muscle attachment it makes a close coil on itself, very typical of the organ in this and allied genera, of which a comparison may be made with the similar coil in *M. hardwickei* (Plate XXVIII. figs. 1 *a*, 1 *b*, Plate XXXII. fig. 5 *b*, &c.); from this it is straight and cylindrical to the generative aperture.

The amatorial organ is present as a large gradually tapering cylinder, with a retractor muscle at the posterior end. The spermatheca is short and elongately pear-shaped.

Odontophore. The jaw is moderately concave on the cutting-edge, with a well-marked central convex projection. The dental formula referred to on p. 85 is

$$\frac{34 \,.\, 2 \,.\, 9 \,.\, 1 \,.\, 9 \,.\, 2 \,.\, 34}{45 \,.\, 1 \,.\, 45}$$

(88 rows counted).

The central tooth is elongately triangular, with two short pointed cusps on either side at about half the length. The median are similar, tricuspid, the inner cusp being higher, or about midway

between the main point and the outermost; at the tenth and eleventh this inner tooth almost disappears, and the first laterals are unevenly bicuspid, the inner cusp being the longest; the outermost laterals decrease gradually in size, and at last are short evenly bicuspid teeth.

Macrochlamys petrosa, Hutton. (Plate XXII. fig. 1; animal, Plate XIX. figs. 1, 1*a*.)

Macrochlamys petrosa (*Helix*?), Hutton, J. A. S. B. vol. iii. p. 83 (1834).

Helix petrosa, Pfr. Mon. Helic. vol. i. p. 56; Conch. Ind. p. 37, pl. lxxxviii. figs. 7–10, and note 18, p. viii (good figure as regards external form, not correct near umbilicus).

Macrochlamys indica, Theobald, Supp. Cat. p. 18.

Nanina vitrinoides, not separated by several authors, and Chemnitz, Helix, no. 689, p. 228 (several species are drawn, all from India).

Locality. Rajmahal on Ganges (*Raban*), 200 miles from the sea at head of the delta.

Shell depressedly conoid, base flat, umbilicated, solid; sculpture, longitudinal lines, rather broad, waved, at irregular distances apart (Plate XXI. fig. 2); colour dull umber-brown, paler beneath; spire moderately high, sides convex; suture adpressed; whorls 6, regularly wound, sides convex, the last rounded; aperture broadly lunate, subvertical; peristome rather thickened, somewhat sinuate on lower margin, very oblique.

Size: maj. diam. 24·2, min. 21·5; alt. axis 10·8, body-whorl 7·5 mm.
,, 0·95, ,, 0·85; ,, 0·43, ,, 0·30 inch.

This shell was sent me by the late Mr. Raban, Bengal C.S. It differs in its form from its very close ally *indica*, from Calcutta, the sides of the spire being rounder, not so tumid below, and in its far larger size. The animal has not been seen by me.

I have identified it with the form Hutton collected near Mirzapur, although I have not seen any shells from that locality; but as he got it at Tara in the low range of rocky hills (August 1832), the Rajmahal shell is very likely to be the same, habitat and climate being similar, and both places lying on the right bank of the Ganges; he also gives the size as about one inch. I have no specimen from Calcutta so large as this. I have already quoted Hutton's description of the animal of *petrosa* in my history of the genus.

The Bhaugulpur form seems identical with Mr. Raban's shells. I give a drawing of the animal taken by H. T. Blanford on July 1st (Plate XIX. figs. 1, 1 *a*), from one made under the superintendence of Ferd. Stoliczka, and among the set of drawings left by him to the library of the Indian Museum, and I append Capt. J. Hutton's description in full.

"No. 3. Genus Helix?

"*Animal.* Dark brown or blackish, with four tentacula, the two superior ones being longest and bearing the eyes at their summits;

tentacula clubbed or forming a button at the tips, retractile; body elongate, with a hooked process on the extremity or tail, pointing backwards; from the right side of the animal proceed two narrow, flat, gradually-pointed filaments or tentacula, which, when the animal is in motion, are kept constantly playing over the surface of the shell, and in all probability give it the high polish it possesses.

"*Shell.* Thin, fragile, pellucid, with a small pillar-cavity, not discovering the previous whorls; whorls six or seven in number; colour pale brownish; shell very glassy, with fine smooth polish; aperture lunated, margins edged and disunited, being interrupted by the body-whorl; diameter about one inch; spire flattened, as are also the sides of the shell more or less.

"I have placed a mark of doubt to the generic name, because I do not find in the description of the genus *Helix* any allusion made to the process on the tail of my specimen, nor to the two tentacula proceeding from the right side of the animal. I found specimens of these shells, dead, in dry ravines and on the banks of the Ganges.

"They live, however, in rocky situations, so that their being found in the above-mentioned places must be owing to the mountain-streams having carried them off during the rains.

"I procured living specimens at Tara, in the range of rocky hills near Mirzapore, in the month of August 1832. In wet weather, or, more properly speaking, during the rains, they sally forth from their retreats in quest of food, which consists chiefly of vegetable matter. They prefer the early hours of morning to feed in, before the sun has sufficient power to become distressing to them. They appear to require a great deal of moisture while in motion, without which the slimy matter, which exudes plentifully from their bodies, becomes so thick as to impede the progress of the animal. I observed this to be the case with several which I kept alive for some time; when a few drops of water were sprinkled upon it the animal put itself in motion and continued so to do until the slimy matter became too thick to allow it to proceed without evident exertion. I never found these shells in motion except on very wet days; and the above circumstance may probably be the reason. At the close of the rainy season they deposit their eggs in the ground, and retire to some secure retreat, where they remain during the cold and dry seasons of the year, protected from the weather by the dark caves or blocks of stone, among which they conceal themselves, shutting up the aperture of the shell with a viscous fluid, which soon hardens, and, becoming like a thick coating of gum, effectually excludes the external air.

"The ova are deposited in long strings, and are white."

Macrochlamys splendens, Hutton. (Plate XXII. figs. 4, 4*a*.)

Nanina splendens, Hutton, J. A. S. B. vol. vii. pt. 1 (1838), p. 215 (form of the shell-lobes not alluded to; they possibly are absent).

Helix splendens, Pfr. Mon. Helic. vol. i. p. 73, vol. iv. p. 124.

Nanina splendens, Gray, Cat. Pulm. p. 89 (1855).

Orobia splendens, Albers, Die Heliceen, 2nd ed. p. 58.

Bensonia splendens, Pfr. Vers. Zeits. Malak. ii. 1855, p. 119.

Nanina splendens, Albers in Malak. Bl. iv. p. 90 (1857).

N. (*Macrochlamys*) *splendens*, W. T. Blf. A. M. N. Hist. 1863, xi. p. 83.

Helix splendens, Conch. Ind. p. 24, pl. li. figs. 7, 10.

Macrochlamys splendens, Semper, Reis. Arch. Phil. p. 17, pl. v. figs. 10–19. This refers to some other species sent by Dr. Anderson, probably from Darjiling.

Macrochlamys splendens, Theob. Cat. Supp. p. 18.

Nanina (*Bensonia*) *splendens*, Nev. Second Yarkand Mission, p. 18.

Bensonia splendens (type), Clessin, Nomen. Helic. p. 41 (1881).

Locality. Nag-Tiba ridge near Mussoorie, N.W. Himalaya.

Shell very depressedly conoid, thin, polished, flat on base, concave round umbilicus; sculpture longitudinal, linear, wide apart, not very regular, ribbon-like, minute transverse lines of growth (Plate XXI. fig. 3); colour dark horny brown, pale ochre near aperture; spire flatly convex, apex rounded; suture shallow, adpressed; whorls 8, closely wound, sides above flat, round on the last: aperture narrowly lunate, oblique; peristome thin, straight, slightly sinuate below, scarcely reflected at umbilicus and descending very obliquely; umbilicus almost hidden.

Size: maj. diam. 15·5, min. 14·0; alt. axis 6·8, body-whorl 5·0 inch.
,, 0·61, ,, 0·55; ,, 0·7, ,, 0·20 mm.

Some specimens are considerably larger than this. Abundant under stones and fallen trees at 7000–8000 ft.

Animal. Very pale grey; tentacles grey, extremity of foot glandular.

Original description:—"*Testa discoidea, purpureo-brunnea, polita, leviter concentrice et radiatim striata, striis radiatis remotis, illis confertissime dispositis; spira vix elevata, anfractibus septem (apice omissa) arcte convolutis; apertura lunata, labro striga, incrassata interna distante munitum.*

"Diam. 0·65 (*B.*).

"Animal as in the genus; the colour a dark verdigris-green.

"This beautiful species is found in great abundance in the forest of Mahássó, beneath fallen timber, and in the hollow trunks of decaying trees; it is also plentiful at Fagu and Nagkunda at 9000 ft., and has been met with at Hattu at 10,656 ft. All these places have a greater elevation than Simla, where it has not yet been discovered" (*H.*).

"The closely packed whorls, showing a larger number in a smaller diameter, at once distinguished this species from all the darker-coloured and more depressed varices of *N. vitrinoides*" (*B.*).

I have just obtained spirit-specimens from Mr. Theobald, collected by him at Murree, and the shell now finds a generic resting-place. The animal has a very small right shell-lobe and a small left shell-lobe, the left dorsal lobe being very distinctly divided into two separate lobes. This will be described in more detail. Regarding the genus *Bensonia* referred to, Pfeiffer evidently regarded *labiata*

as the type. Clessin arbitrarily adopts *H. splendens*; but this method of dealing with genera cannot be adopted, and as yet we do not know whether the two species are so much alike as to be placed together. The radula is like *M. indica*, arranged—

30 . 2 . 12 . 1 . 12 . 2 . 30
44 . 1 . 44

MACROCHLAMYS SHENGORENSIS, n. sp. (Plate XXII. fig. 5.)

Nanina (*Microcystis*?), n. sp., Nevill's Hand-list, No. 149 *d*, p. 37 (3 sp. Shengor), is the young.

Locality. Shengor Peak, Dafla Hills.

Shell discoid, narrowly umbilicated, glassy, flat on base (not fully grown); sculpture longitudinal striæ, regular and broadly ridged, also showing as spiral striæ on the base; colour olivaceous brown; spire quite depressed, apex flat; suture very shallow; whorls 4, sides flat above, rounded on periphery; aperture lunate, moderately large, nearly vertical; peristome thin, oblique below, a good deal reflected over the umbilicus.

Size: maj. diam. 11·2, min. 10·0; alt. axis 4·3, body-whorl 3·8 mm.
,, 0·44, ,, 0·39; ,, 0·17, ,, 0·15 inch.

A small specimen of 2½ whorls sent back to me by Mr. Nevill out of a series of Dafla shells given by me to the Calcutta Museum is, no doubt, the young of this species, the apex and spiral curve and sculpture being exactly similar. A number of these minute Helices will, I think, turn out to be young shells.

MACROCHLAMYS?* CHOINIX, Bs. (Plate XXII. figs. 6, 6 *a*.)

Helix choinix, Bs. A. M. N. Hist. 1861, vii. p. 83; Conch. Ind. p. 24, pl. li. fig. 1 (not correct on columellar margin); Pfr. Mon. Hel. vol. v. p. 117.

Macrochlamys choinix, Theob. Cat. Supp. p. 17.

Nanina (*Macrochlamys*) *choinix*, Nev. Hand-list, p. 23.

Locality. Andaman Islands.

Sculpture of the figured specimen, longitudinally broadly arranged striæ, irregular.

Size: major diam. 16·0, minor diam. 12·75, alt. axis 5 mm.

Original description:—" H. *testa perforata, vix conoidea-depressa, tenui, oblique striatula, striis exilissimis spiralibus confertissime decussata, superne fusco-cornea, subtus pallidiore, translucente; spira subconoideo-planulata, apice vix elevato, obtuso, sutura leviter impressa, submarginata; anfractibus* 6, *vix convexiusculis, superioribus arctius convolutis, ultimo majore, ad peripheriam superne subangulato-rotundato, subtus convexiusculo; apertura obliqua, magna, late lunata; peristomate tenui, acuto, margine dextro superne arcuatim prominente, columellari prope umbilicum breviter dilatato.*

" Diam. major 17, minor 14½, axis 8 mill.; apert. 9½ mill. lata, 8 mill. longa.

" Habitat in Insulis Andamanicis.

" A naninoid shell, with the last whorl large in proportion to those

* This query denotes that the animal has not been described, and that the generic position is still doubtful.

of the spire. It has not yet been found in a living state. For the specimens which are most perfect in form I believe myself to be indebted to the late Superintendent, Dr. Walker. A broken specimen, with the surface in good condition, was transmitted by Captain Haughton."

Shells of same form as preceding species. *Sculpture longitudinal, each fine rib broken up into papillate dots.*

Macrochlamys ? exul, Theobald. (Plate XXII. fig. 3.)

Helix exul, Theobald, J. A. S. B. 1864, p. 245.

Orobia andamanensis, Tryon, Amer. J. C. vol. v. p. 110, pl. 10. fig. 4; *vide* Stoliczka, J. A. S. B. 1870, p. 87.

Helix andamanensis, Conch. Ind. p. 28, pl. lxii. figs. 1, 2, 3.

Macrochlamys andamanensis, Theob. Cat. Supp. p. 18.

Macrochlamys exul, Nev. Hand-list, p. 23 (Mt. Harriet).

Locality. Andamans (*Harold Godwin-Austen*).

Shell narrowly umbilicated, subdepressedly conoid, polished; sculpture regular, broad, longitudinal bands marked by fine striæ; colour pure ochre; spire depressedly conoid, apex rounded; suture shallow; whorls 5, the last rounded; aperture broadly lunate; peristome thin, a white deposit on the body-whorl, scarcely reflected at the columellar margin, which is oblique.

Size: maj. diam. 16·0,	min. 14·5;	alt. axis 7·2,	body-whorl 5·8 mm.
„ 0·63,	„ 0·57;	„ 0·28,	„ 0·23 inch.

Original description:—"*Testa anguste umbilicata, depresso-conoidea, lævi, tenui, striatula, concolore fusca; apice obtuso; anfractibus sex, tarde crescentibus, convexiusculis, ultimo non descendente; apertura obliqua; peristomate recto, tenui, juxta umbilicum leviter reflexo.* Long. 16·5, lat. 15, alt. 8·5 mill. Habitat in insulis Andamanicis."

"This shell seems a *Nanina* and somewhat recalls *N. semifusca*, Dh., but is a more tumid species."

Macrochlamys prona, Nevill. (Plate XXII. figs. 2, 2 *a*.)

=*masuriensis*, MS. G.-A. Part III. Plate XXI.

Macrochlamys prona, Nevill, Moll. Yarkand Exped. p. 17 (1878); ? Nevill, Hand-list, No. 18, p. 21 (10 sp. Naini Tal).

Locality. Masuri, N.W. Himalaya.

Shell umbilicated, discoidal, base flat; sculpture linear-longitudinal, each line formed by close-set papillate dots (Plate XXI. fig. 8); colour pale sienna-brown, a darker conspicuous band of same colour near aperture, progress of growth is shown by the ochreous bands behind it at intervals; spire very depressed, apex very flattened; suture adpressed; whorls 6, regularly increasing, sides flat above, rounded on the last; aperture lunate, subvertical; peristome thin, straight, scarcely reflected, and very obliquely descending at the umbilicus.

Size: maj. diam. 18·2,	min. 16·2;	alt. axis 7·0,	body-whorl 4·8 mm.
„ 0·72,	„ 0·63;	„ 0·28,	„ 0·19 inch.

Animal (from note-book). Very black and long, a very sharp-

pointed lobe over the mucous gland at extremity of foot. Mantle slightly reflected over the margin of the peristome, with two tongue-shaped expansions, which the animal expands and contracts. This shell I found in a semifossil state embedded in the deposits of tufa in crevasses of the limestone.

The colour of this snail distinguishes it at once from the species of the Gangetic delta.

The specimens above described were shown by me to Capt. T. Hutton, and he at once advised my noting the colour of the animal, and gave me the title *petrosa*. Captain Hutton, some years after, presented me with all the shell-pamphlets he possessed, which had been most of them given him by Mr. W. H. Benson. In one (Ann. & Mag. Nat. Hist. Sept. 1848, on p. 163) I find the following note in Benson's handwriting :—" Hutton's original *H. petrosa* was from Mirzapur. Query, is it identical with the mountain form from Mussoorie which he now refers to that name ?"

To this again is appended a note by Hutton, as follows :—" With reference to Benson's query as to whether the Mirzapur shell was the same as that of Mussoorie, I answer certainly not, as he must have known, having both species before him ; the Mirzapur shell was *Nanina vitrinoides* of Deshayes, the other *Nanina petrosa* (nob.), the name being altered by Benson's advice. When I first found *N. vitrinoides*, I knew nothing of species and recorded my discoveries haphazard.

" Benson thought the Mussoorie shell a mere variety of *N. vitrinoides* ; but as we differed he recommended my giving it a name, which I did, and I still regard the species as distinct. (Signed T. H.) "

We now know how it was that between them the title *petrosa* was altered. The Mirzapur form known to Benson as *vitrinoides* must retain Hutton's original name *petrosa*, and Mr. Nevill has since indicated and described the "Masuri" species under the distinctive name *prona*. The exact range of *petrosa* has yet to be defined (*vide* my remarks on the species from Rajmahal).

The specific designation *prona* may have been taken from a MS. name of Mr. W. T. Blanford's or *vice versâ* ; for in his collection and in his MS. list of it *prona* is the name given to the species from Parisnath, which is, I find, also distinct, and I have therefore had to describe it under the title *jainiana*.

Original description :—" Shell small, of the same group as *N. petrosa*, Hutt. &c., but with closer-wound whorls ; it is a form which apparently is widely spread throughout the North-western Himalayas, as the Museum possesses numerous specimens from Simla, Masuri, Naini Tal, and Sahárunpur ; two specimens found by Colonel Godwin-Austen in the Dafla Hills also apparently belong here*. A very similar small form, but I think specifically distinct, is also found in the Bombay Presidency. Dr. Stoliczka's specimens from Murree are all young or in bad preservation ; I have therefore determined on not naming the species from his Murree specimens, but take as my type the common North-west Himalayan form, the animal of

* These I have not seen, and I doubt the identification.– G. A.

which is known and which is usually recorded in collections as *N. petrosa*. Colonel Godwin-Austen informs me that Hutton himself transferred his own name *petrosa* from the Mirzapur shell to the Masuri one on the strength of Benson's statement that the former was identical with the Calcutta *N. vitrinoides*, in which, as already stated, Benson was quite wrong. This species is not figured in the 'Conchologia Indica,' as far as I can see. Whorls six, closely wound, the last only slightly deflected, sometimes not at all, in which case, of course, the aperture is quite vertical; spire almost or quite flat; periphery rounded; umbilicus resembling that of *M. petrosa*, more open than in all other allied species; horny brown colour, smooth and polished above and below, margins of aperture distinctly but slightly thickened. Type from Naini Tál: diam. 12, axis $4\frac{1}{2}$, apert. lat. 6, alt. $4\frac{3}{4}$ mm."

The following extract may also refer to this species; the shells from the two localities require examination:—

"*Nanina vitrinoides*?, Deshayes (J. A. S. B. vol. vii. p. 215), occurring in valleys near Subathu.

"At Simla a scarce variety is found 'with a rib-like incrassation within the aperture, like many of the specimens of another variety found in Bengal.' Attains a large size and animal is of a dark green colour" (*Hutton*).

Shells of similar form as the preceding; sculpture, *very fine, regular, and delicate longitudinal striation.* (See Part III. Plate XXI. figs. 9 and 10.)

Macrochlamys hardwickei, n. sp. (Plate XXIII. fig. 1.)

Locality. Calcutta, the cemetery at end of Park Street (*G.-A.*).

Shell subconoid, slightly tumid below; sculpture regularly and delicately striate longitudinally, the striæ sharply defined, about 3 $=\frac{1}{1000}$ inch (Plate XXI. fig. 10); colour dull ochraceous brown, with a greenish tint; spire conoid, sides rather flat, apex blunt; suture moderately impressed; whorls 6, regularly increasing; aperture large, laterally ovate and well rounded on the upper outer margin; peristome thin, straight, suboblique, columellar margin obliquely descending and well reflected at the umbilicus, which is not concealed.

Size: maj. diam. 16·2, min. 14·4; alt. axis 7·0, body-whorl 5·2 mm.
,, 0·64, ,, 0·57; ,, 0·28, ,, 0·21 inch.

Animal. Body and tentacles of the same pale grey tint; the mantle is very pale ochraceous, in marked contrast with the rest of the body; the pallial margin is narrow and ill-defined, and the surface of the animal peculiarly smooth. A tongue-shaped expansion is situated close in at the inner margin of the aperture, given off from the right anterior mantle-lobe, and is directed sideways and upwards over the periphery towards the apex, and can be extended for 0·15 inch; another linguiform expansion, but very small, is to be seen on the lower margin a short distance from the umbilicus and reflected back over the shell. The mucous gland has a short but pointed lobe above it.

The odontophore consists of 109 rows of teeth, the formula being

50 . 1 . 12 . 1 . 12 . 1 . 50
63 . 1 . 63

The centre tooth is tricuspid, two short cusps at the base of the long central; the median teeth have a single outer basal cusp; the laterals are bicuspid, the outer points rather shorter than the inner, but rising gradually as they approach the margin of the lingual ribbon (Plate XXVIII. fig. 1).

The generative organs (Plate XXVIII. fig. 1 *a*) are as in *M. indica*, the spermatheca being longer. There are, however, some differences in the penis; the kalc-sac is very long, a flagellum-like appendage, in which a partially formed spermatophore could be detected (fig. 1 *b*), the gland of the retractor muscle, which is in the form of a sort of coiled cæcum, and which appears to be developed from a part of the duct being bent and laid together for a portion of its length and then coiled on itself from the extreme end; and at this point, as in so many of these Indian genera, the retractor muscle is given off.

Thus as regards the odontophore and generative organs considerable modifications exist in comparison with *M. indica.*

Macrochlamys hardwickei, n. sp. (Plate XXIII. fig. 2.)

Locality. Chatak, on Barak river, Sylhet District, Lower Bengal.

Shell umbilicated, subdepressedly conoid, thin, surface dull glassy; sculpture beautifully and regularly striate longitudinally, but very fine (Plate XXI. fig. 9, *sylhetensis*, MS.); colour pale corneous; spire depressed, apex rather blunt; suture adpressed; whorls 6, the last rapidly enlarging, rather tumid below; aperture subvertical, globosely lunate; peristome thin, the columellar margin nearly vertical and but slightly reflected at the umbilicus.

Size: major diam. 16·2, minor diam. 14·2, alt. axis 6·8 mm.
„ 0·64, „ 0·56, „ 0·27 inch.

The animal is thus described in my field note-book:—"With long foot, light faint green, pink at the extremity of the foot; underside of the foot of a pale orange-colour, of a richer tint near the mouth. Eye-pedicels of a light neutral tint. Mantle rather expanded. Tentacles very long, the oral drooping. Extremity of foot glandular, rather truncate, lobe above small"* (Plate XVIII. fig. 4).

Macrochlamys hardwickei, var.

Locality. Barowli river, Durrang District, Assam (*J. Burt*).

Shell depressedly conoid, umbilicated, smooth, transparent; sculpture fine longitudinal striæ, $3 = \frac{1}{1000}$ inch; colour very pale dull olive-brown or horny; spire depressed; suture adpressed, shallow; whorls 6, flat on spire, rounded on the last and moderately swollen; aperture widely lunate, subvertical; peristome thin, straight, and nearly perpendicular on the columellar margin, very slightly reflected; umbilicus small but open.

* No mention is made of the linguiform appendages to mantle, but they were probably overlooked.

Size: maj. diam. 16·3, min. 14·0; alt. axis 6·2, body-whorl 5·0 mm.
„ 0·64, „ 0·55; „ 0·24, „ 0·20 inch.

MACROCHLAMYS HARDWICKEI, var. (Plate XXIII. fig. 4.)

Locality. Barroi Gorge, Durrang District, Assam (*H. H. G.-A.*).

Sculpture smooth, but with very fine regular longitudinal striation, 5 lines $=\frac{1}{1000}$ inch.

Size: maj. diam. 16·4, min. 14·0; alt. axis 7·0, body-whorl 5·5 mm.

MACROCHLAMYS HARDWICKEI, var.

Locality. Brahmakund, Upper Assam (*Mr. M. J. Ogle*).

Shell thin, very depressedly conoid, umbilicated; sculpture micro-longitudinal striæ, in some specimens not to be discerned; colour dull whity brown; spire low; suture shallow, impressed; whorls 5, flat above, rounded on the periphery; aperture laterally ovate, oblique; peristome thin, with much obliquity on the columellar margin, and but slightly inflected at the umbilicus.

Size: maj. diam. 14·0, min. 12·0; alt. axis 4·0, body-whorl 3·0 mm.
„ 0·56, „ 0·48; „ 0·16, „ 0·12 inch.

MACROCHLAMYS HARDWICKEI, var. POLITULUS. (Plate XXIII. fig. 3.)

Locality. Upper Assam (*Mr. M. J. Ogle*).

Shell subglobosely conoid, rounded below, with glassy lustre; sculpture very fine longitudinal striæ, not continuous far in a straight line, the parallelism being broken at intervals by the wavy transverse lines; colour pale horny brown; spire subconoid; suture shallow; whorls 6, the last rounded and rather tumid; aperture ovately lunate, subvertical; peristome thin, straight, columellar margin oblique, descending, slightly reflected at the umbilicus, which is not hidden by it.

Size: maj. diam. 15·0, min. 12·8; alt. axis 6·2, body-whorl 5·4 mm.
„ 0·59, „ 0·50; „ 0·24, „ 0·21 inch.

Animal not seen. This form is but slightly removed from the typical Calcutta one, but it is flatter on the base, with finer sculpture, and in a large series of some 40 specimens all are of the same pale tint of sienna-brown; whereas an equally large series from the Durrang Hills are all of an extremely pale tint of ochre or nearly white.

MACROCHLAMYS HARDWICKEI, var. POLITULUS. (Another specimen.)

Locality. Upper Assam (*Mr. M. J. Ogle*).

Shell depressedly conoid, base rather flat, umbilicated, thin, diaphanous, glassy; sculpture with fine transverse lines of growth, but under lens shows fine, regular, longitudinal striæ, the surface in some slightly waved, $6=\frac{1}{1000}$ inch; colour pale sienna-brown; whorls 6, regularly increasing.

Size: major diam. 15·2, minor diam. 14·0, alt. axis 6 5 mm.
„ 0·60, „ 0·56, „ 0·26 inch.

MACROCHLAMYS LHOTAENSIS, n. sp. (Plate XXIII. fig. 5.)

Locality. Lhota-Naga Hills (*A. W. Chennell*).

Shell very thin, umbilicated, depressedly conoid, flattish on base; sculpture very deep, regular, longitudinal striæ, crossed by numerous fine lines of growth (Plate XXI. fig. 5); colour dark horny; spire low, apex blunt; suture moderately defined; whorls 7, flat above, periphery rounding suddenly; aperture ovate; peristome straight above, sinuate below, slight reflexion and very oblique near umbilicus.

Size: maj. diam. 23·0, min. 19·8; alt. axis 8·0, body-whorl 6·5 mm.
,, 0·61, ,, 0·76; ,, 0·32, ,, 0·26 inch.

This is a very distinct large species, unlike in its form, thin texture, and sculpture the many other closely allied forms.

Macrochlamys opiparus, n. sp. (Plate XXIII. figs. 6, 6 *a*.)

Locality. Darjiling.

Shell globose, subconoid above, umbilicated, rather solid; sculpture above with minute, irregular, transverse lines of growth; roughly, coarsely, and unevenly striate longitudinally; colour dull ochre, with a pale brown band bordering the peristome; spire, apex blunt; suture impressed; whorls 6, convex, the last well rounded on the periphery and much swollen; aperture globosely lunate, subvertical; peristome thin, straight, subvertical on the columellar margin and slightly reflected near umbilicus.

Size: major diam. 16·7, minor diam. 14·0, alt. axis 7·0 mm;
,, 0·66, ,, 0·56, ,, 0·28 inch;
alt. body-whorl above the columellar margin 5·8 mm.
,, ,, ,, 0·23 inch.

Macrochlamys kala, n. sp. (Plate XL. figs. 1, 1*a*, 1 *b*.)

Locality. Damsang Peak, Daling Hills, Western Bhutan (*W. Robert*).

Shell closely perforate, depressedly conoid, base flat, thin, transparent, glassy; sculpture fine, regular longitudinal striæ (similar to figs. 9, 10, Plate XXI., rather coarser); colour very pale ashy ochre; spire flatly conoid; whorls 5, slightly convex above; aperture subvertical, lunate; peristome circular on outer margin; columellar margin subvertical, weak.

Size: maj. diam. 9·0, min. 7·0; alt. axis 3·5, body-whorl 2·5 mm.
,, 0·36, ,, 0·28; ,, 0·14, ,, 0·10 inch.

The animal may be distinguished at once by its very dark colour above, contrasting with the light colour of the pedal margin and sole of the foot below. It is a true *Macrochlamys*, with the usual right and left shell-lobes present (Plate XL. figs. 2, 3, 4). The left dorsal is divided into an anterior and posterior lobe.

The generative system (fig. 5) is wanting in the usual amatorial organ, and the male organ is more simple than in *M. indica* and thout the coiled cæcum. The spermatophore is beautifully displayed in most of the specimens I have examined, both in course of formation within the male organ (fig. 6) and also where it has been received into the spermatheca (fig. 7). At its posterior portion it is

beset with a series of small recurved hooks arranged in a band along one side, passing into a line of single hooks extending to the pointed cap-like anterior end.

In the radula (figs. 9, 9 *a*) the central tooth is tricuspid, of usual shape; the median teeth with a single basal cusp on the outer margin; the laterals are evenly bicuspid, and very minute on the outer margin.

40 . 2 . 8 . 1 . 8 . 2 . 40
50 . 1 . 50

The jaw (fig. 8) is straight in front, with a slight central projection.

Shells depressedly conoid, of large or moderate size, the surface of the shell *perfectly smooth.*

MACROCHLAMYS ? RESPLENDENS, Phil. (Plate XXVI. fig. 1.)

Helix resplendens, Phil. in Zeitschr. f. Malak. 1846, p. 192; Chemn. ed. 2, n. 688, t. cx. f. 7–9; Pfr. Mon. Hel. i. p. 56, v. p. 100; Reeve, Conch. Icon. t. 81.* f. 430.

Helix expolita, Desh. in Fér. i. 190. n. 255, t. 87. f. 1.

Nanina resplendens, Trosch. in Arch. f. Nat. 1849, i. p. 234.

Xesta resplendens, Albers, Helic. p. 95.

Nanina resplendens, Gray, Cat. Pulm. p. 82.

Helix resplendens, Conch. Ind. p. 24, pl. li. fig. 4 (is not this species).

Macrochlamys resplendens, sec. A, Theob. Supp. Cat. p. 18; Nev. Hand-list, p. 20.

Locality. Mergui (*Theobald*).

Shell subperforate, very depressedly conoid, shining, thin, smooth; colour ochraceous, greyer below; spire flatly conoid; whorls 6½, closely wound and increasing very gradually and evenly; aperture nearly vertical, lunate; peristome thin, acute; columellar margin oblique and not reflected until close to the umbilicus, and then but slightly so.

Size: maj. diam. 25·5, min. 23·0; alt. axis 10·0, body-whorl 8·0 mm.
,, 1·0, ,, 0·91; ,, 0·40, ,, 0·32 inch.

I am indebted to Mr. W. Theobald for a fine example from the typical locality, which is 6·5 mm. larger than the original specimen described.

Original description:—"H. *testa subperforata, depressa, glaberrima, lucida, tenui, pellucida, lutescenti-cornea; spira vix prominula; anfr.* 6½, *convexiusculis, ultimo regulariter aucto, basi convexiusculo, medio profunde impresso; apertura fere verticali, depressa, lata, lunari; peristomate simplice, acuto, margine columellari in centro baseos brevissime reflexo.*

"Diam. 8–9, alt. 4‴.

"Prope Mergui Indiæ Orientalis legit Th. Philippi."

* The form here represented with the high spire is not at all like the typical species I have seen; and, from the habitat Burmah, it is evidently some other species, not unlike those examples of *M. atricolor* from Upper Burmah named *resplendens* by Nevill.

Macrochlamys resplendens, Phil. (Plate XXVI. fig. 2.)

Locality. Cambodia (ex coll. H. Adams).

Shell similar to Mergui specimen in form, more discoid; colour umber-brown, paler grey below; spire very flat, not so high; suture well impressed; whorls 6.

Size: maj. diam. 21·8, min. 18·8; alt. axis 8·0, body-whorl 6·8 mm.
,, 0·86, ,, 0·74; ,, 0·32, ,, 0·27 inch.

This shell is very close to the last, but is smaller and flatter above and below, and not so tumid.

Macrochlamys resplendens, Phil. (Plate XXVI. fig. 3.)

Locality. Siam (*Mr. R. Damon*).

Shell similar to Mergui specimen, but smaller and body-whorl less tumid; colour very pale umber-brown, with a grey tinge below; whorls 5.

Size: maj. diam. 19·0, min. 17·0; alt. axis 7·5, body-whorl 6·5 mm.
,, 0·75, ,, 0·67; ,, 0·30, ,, 0·26 inch.

Macrochlamys subcornea, Pfeiffer, P. Z. S. 1861, p. 20; Mon. Hel. vol. v. p. 103; Mal. Blät. 1860, p. 232, from Siam (Mouhot, coll. Cuming), is a much closer-wound shell than any I possess; and I doubt the identification by Hanley of one of Theobald's shells from Phie Than, figured in Conch. Ind. pl. cxlix. figs. 2, 3, and which I believe is a young specimen of *resplendens*.

Macrochlamys? consepta, Bs., small var.? (Plate XXVI. fig. 4.)

Helix consepta, Benson, A. M. N. Hist. Sept. 1860, vi. p. 190 (dwarf var.), and 1863, xi. p. 320; Pfr. Mon. Hel. v. p. 239; Conch. Ind. p. 37, pl. lxxxviii. figs. 5, 6.

Macrochlamys consepta, Theob. Supp. Cat. p. 19; Nev. Hand-list, p. 22 (from Pegu).

Locality. Mulé-it range, 4000 feet, Tenasserim (*O. Limborg*).

Shell, perforation nearly hidden, globosely conoid and depressed above, flat on base, rather thickened, with shining surface; sculpture none; colour pale olivaceous ochre, stronger near peristome; spire low, scarcely elevated, apex rounded; suture shallow; whorls 6, closely wound; aperture narrowly lunate; peristome thickened; columellar margin very oblique, slightly reflected at the upper portion.

Size: maj. diam. 14·5, min. 12·3; alt. axis 6·0, body-whorl 5·70 mm.
,, 0·57, ,, 0·48; ,, 0·24, ,, 0·22 inch.

This shell was compared with a specimen marked from the typical locality Mergui, and labelled *resplendens*, in Mr. Sylvanus Hanley's collection; it has some characters in common; but its more solid smaller form does not at all agree with the shell received from Mr. Theobald (*vide* p. 109, Plate XXVI. fig. 1), concerning which no doubt exists regarding its locality. I have not been able to compare it with the type specimen described by Benson.

This may be also *cycloidea*, Albers (*Helix cycloidea*, Albers, Malak. Blätt. 1857, p. 89, pl. i. figs. 1, 2, 3; Pfr. Mon. Hel. vol. iv. p. 43; *Macrochlamys*, sec. A, Theob. Supp. Cat. p. 18), which I have never seen.

Original description:—"*Testa subperforata, orbiculari, subdiscoidea, nitida, radiatim striatula, superne obsolete spiraliter striata, pallide cornea; spira depresso-conoidea, apice elevatiusculo, obtuso, sutura impressa, marginata; anfractibus* 8, *angustis, convexiusculis, lente accrescentibus, ultimo ad peripheriam rotundato, subtus medio excavato; apertura subverticali, late lunari, peristomate albido, intus late incrassato-marginato, superne recto, margine basali expansiusculo, undulato, crassiusculo, columellari brevissime reflexo.*

"Diam. major vix 18, minor 15½, axis 7 mill.

"Habitat ad Damathá, prope Moulmein. Detexit Capt. J. C. Haughton.

"A single specimen is in the collection of Mr. Theobald."

Macrochlamys jainiana, n. sp. (Plate XXVI. fig. 7 & Plate XXVIII. figs. 2–2 *e*.)

= *prona*, MS. coll. Blanf., = *perplana*, MS. in pencil on a drawing by Stoliczka.

Locality. Manbhum (*V. Ball*); Parisnath (*W. T. Blf.*).

Shell umbilicated, discoid, glassy, some specimens very thin; sculpture none, surface quite smooth; colour dark brown, paler beneath, often of a rich burnt-sienna tint; spire flat, scarcely raised above the body-whorl; suture shallow; whorls 6, the last well rounded on the periphery; aperture subvertical, broadly and laterally lunate; peristome oblique on the columellar margin.

Size: maj. diam. 20·0, min. 16·3; alt. axis 6·0, body-whorl 5·3 mm.
,, 20·3, ,, 18·0 (*Blanford coll.*, Parisnath).
,, 18·8, ,, 15·8 (*V. Ball*); alt. ax. 6·5, body-wh. 5·8.

Besides other characters the umbilicus is more open in this species than in *M. indica*, *petrosa*, &c.

Animal. The foot evidently very long, and the lobe overhanging. There is a small right shell-lobe and a small left shell-lobe, and the amatorial organ is present; but in the animals examined the generative organs were broken up and very hard. However, portions of the spermatophore (Plate XXVIII. figs. 2 *b*–2 *e*) were preserved, which was of lengthened form, with a series of bicuspid processes along the sides, these being set closer together at the basal end (fig. 2 *d*); a portion of the sac of the spermatophore with its convoluted contents was also preserved (fig. 2 *e*).

Odontophore. The jaw (fig. 2 *a*) has the central projection; the central teeth are as in *M. indica* (fig. 2), but in the laterals (fig. 2. 17–20) we find a good specific character; they are not, as is usual in most species of *Macrochlamys*, bicuspid, but are long and straight, with a very minute notch near the apex, and this is not apparent

in the smaller outermost teeth. The formula is

$$\begin{array}{c} 27 \;.\; 15 \;.\; 1 \;.\; 15 \;.\; 27 \\ 42 \;.\; 1 \;.\; 42 \end{array}$$

In another specimen from Manbhum

$$\begin{array}{c} 38 \;.\; 12 \;.\; 1 \;.\; 12 \;.\; 38 \\ 50 \;.\; 1 \;.\; 50 \end{array}$$

Among the drawings left us by Ferd. Stoliczka is one which I have reproduced on Plate XIX. fig. 4, and which, from its flattened form, may be the young of *M. jainiana*. Under the original drawing Nevill has written "*N. perplana*"; in pencil Stoliczka records as follows:—"*Macrochlamys* like *lugubris* (a MS. name), Parisnath. Shell of flattened form. Both mantle-lobes very long and narrow; mantle greenish splashed white, whole body of a distinct greenish tinge; anterior part, especially on the pedicles and back, black; middle part pale; posterior part dark above, less dark at the sides."

N. perplana, Nevill, MS., was never described; it is *Nanina*, No. 23, p. 22, not named, in Nevill's Hand-list Mollusca, Dec. 1878, with above description of the animal by Stoliczka somewhat altered.

Eight specimens of the shell are in the Indian Museum from Dr. F. Stoliczka's collection; but as I am not able to compare them with the shells in my own, I have not retained Nevill's MS. title.

Macrochlamys jainiana. (Plate XXVI. fig. 8.) = *stricklandi*, MS., G.-A., Part III. p. 12.

Locality. Madhopur, Jeypur (*Captain A. B. Melville*).

Shell umbilicated, depressedly conoid, glassy, rather solid; sculpture none, surface quite smooth; colour pale umber-brown in parts, but greatly bleached; spire low, apex rounded; suture shallow; whorls 6, regularly increasing, periphery of last rounded; aperture subvertical, semiovate; peristome thin; columellar margin oblique, not reflected.

Size: maj. diam. 16·2, min. 14·0; alt. axis 6·3, body-whorl 5·3 mm.
„ 0·64, „ 0·56; „ 0·25, „ 0·21 inch.

I also have a small specimen, 13·0 in major diam., from Borlai in Central India, collected by Mr. N. Belletty.

Macrochlamys? politissima, Pfr. (Plate XXVI. fig. 6.)

Helix politissima, Pfeiffer, P. Z. S. 1853, p. 125; Mon. Hel. vol. iv. p. 45; Reeve, Conch. Icon. *Helix*, f. 1292; Hanley, Conch. Ind. p. 15, pl. xxxi. figs. 8, 9.

Macrochlamys (sec. A) *politissima*, Theob. Supp. Cat. p. 18.

Nanina (*Macrochl.*) *politissima*, Nev. Hand-list, p. 22.

Locality. Ceylon.

Sculpture none; glassy surface.

Size: maj. diam. 22·0, min. 18·5; alt. axis 8·0, body-whorl 7·0 mm.
„ 0·87, „ 0·73; „ 0·32, „ 0·28 inch.

Original description:—"H. *testa subaperte perforata, depressa,*

tenui, politissima, virenti-cornea vel castanea; spira vix elevata, vertice subtili, obtuso; sutura profunda; anfractibus $4\frac{1}{2}$, *convexis, sensim accrescentibus, ultimo rotundato, non descendente; apertura parum obliqua; rotundato-lunari; peristomate simplice, recto, marginibus convergentibus, dextro antrorsum subarcuato, columellari arcuatim descendente, superne breviter reflexo.*

"Diam. maj. 24, min. 20, alt. 11 mill.

"*Hab.* in insula Ceylon (*Thwaites*)."

Shells depressedly conoid, of large or moderate size, the surfaces *perfectly smooth.*

MACROCHLAMYS ATRICOLOR, Godwin-Austen. (Plate XXIV. fig. 1.)

Helix (*Nanina*) *atricolor*, J. A. S. B. 1875, p. 2, pl. 1. fig. 2.

Nanina (*Macrochlamys*) *atricolor*, Nev. Hand-list, p. 20, as var. of *resplendens*, Phil.

Locality. N. Cachar Hills (typical locality).

Sculpture none, perfectly smooth; colour olivaceous ochre or umber-brown, with a stronger band of colour bordering the peristome.

Largest specimen:—

Size: maj. diam. 22·5, min. 19·5; alt. axis 9·4, body-whorl 8·8 mm.

Original description:—"Shell imperforate, depressedly conoid, very strong; colour varying from rich bright brown to greenish ochre, pure brown or ochre near aperture, with a glassy surface finely striated (*i. e.* by mere transverse additions of growth); spire flatly conoid; whorls $6\frac{1}{2}$, periphery rounded, flat at base; aperture suboblique, broadly lunate; peristome well thickened and slightly reflected near the columella.

"Major diam. 0·93, minor 0·85, alt. 0·45 inch.

"Animal quite black throughout; tentacles long, with extremities paler; extremity of foot short and glandular, as in *Nanina decussata*, Bs."

Size: maj. diam. 23·0, min. 21·0; alt. axis 8·75, body-whorl 7·2 mm.
,, 0·91, ,, 0·83; ,, 0·35, ,, 0·28 inch.

"*Habitat.* On the higher parts of the North Cachar Hills, never seen to the westward of that portion of the range, and tolerably abundant in certain spots."

The colour of the animal is its most distinctive character.

MACROCHLAMYS ATRICOLOR, Godwin-Austen (large var.). (Plate XXIV. fig. 2.)

Locality. Munipur Hills (*M. J. Ogle*).

Shell subperforate, depressedly globose, base very flat, shining polished surface, perfectly smooth; colour dark chestnut-brown, brighter and more ochraceous near the peristome; spire flat and apex rather rounded; suture shallow; whorls 5, regularly in-

creasing, flatly convex above; aperture subvertical, broadly lunate, directed obliquely downwards from the columellar side; columellar margin very oblique.

Largest specimen:—

Size: maj. diam. 28·0, min. 23·5; alt. axis 10·0, body-whorl 8·75 mm.
„ 1·0, „ 0·93; „ 0·40, „ 0·34 inch.

This shell may be known from similar forms, even when young, by its more tumid and rounded form below, the rounded apex and shallow suture, and particularly the milky white colour of the interior of the aperture, which in adult shells often covers the columellar side of the body-whorl, also the strong band of colour bordering the peristome.

Animal (Plate XXV.). The right shell-lobe (*r.s.l.*, figs. 1, 2, and 8) is well developed and must be of considerable length when extended in life, for it is very long in the beautifully preserved specimens sent me by Mr. Ogle; the left shell-lobe overlaps the edge of the peristome as a simple band for its entire length (figs. 3, 4, and 8), and there is no tongue-like shell-lobe given off as in *M. indica* (*vide* figs. 9 and 10, representing the mantle removed, and viewed from above and from beneath). The right dorsal lobe is as in *M. indica*, but the left is more decidedly divided into two portions (figs. 1, 3, and 4), the posterior being almost a separate lobe by itself, and has that appearance when viewed from the exterior side, though the connexion is seen from below (*vide* fig. 8). The sole of the foot is divided into the usual central and side portions, and the segmental lines run quite across it from side to side.

The pedal line is particularly well defined by two parallel grooves, enclosing a series (as in all these forms) of oblong epidermal spaces. On reaching the large elongate labial tubercle, situated on either side below the mouth, this pedal line is continued diagonally backwards and follows a distinct deep groove, which leads up to the posterior upper part of the neck underneath the mantle-lobes. A row of tubercles also starting from the above labial tubercle borders this groove on its upper margin, and thus distinctly divides the prosoma with the mouth, tentacles, and generative apparatus from the muscular foot, and would correspond to the more distinct rostrum-like head of some species of Cyclophoridæ &c. (figs. 4 and 5). Along this groove the mucous fluid as it is secreted no doubt would be carried and thence beneath the mantle completely over the dorsal part of the animal, thence down the lateral grooves, meeting the flow of the same fluid at their junction with the pedal line, to be eventually thrown off at the extremity. Mr. J. Wood-Mason, in a paper published in the P. A. S. B. March 1882, enters into the question of this pedal groove (his peripheral groove), and was the first to define its use. He does not appear to have considered this oblique groove, which would so much more completely spread the lubricating fluid over every part of the animal, and without the exclusive aid of the ciliated surface; however, this groove is not so distinctly seen in most other species.

The extremity of the foot (fig. 7) is somewhat truncate, the lobe overhanging the mucous gland, which does not extend to the base or sole of the foot.

Referring to the above paper by Mr. Wood-Mason, the taxonomic value of this organ is no doubt considerable. He says, " As Pulmonata possessing a ciliated peripodium with and without a terminal pit were found in every quarter of the globe, and as it was in the highest degree improbable that so highly specialized a structure subserving such an important purpose in the animal economy as this evidently did had arisen independently many times in many different forms in many widely separated areas of the earth's surface, he considered that it had a higher taxonomic value than had hitherto been assigned to it."

Mr. Wood-Mason proposed " to distinguish those forms that possessed it and those that did not (or had lost it) from one another by calling them Craspedophora and Lipocraspeda respectively." Similar distinctive titles had been given by Desmoulins in 1829, PhereporÆ and AporÆ respectively. I do not think its function is merely to catch the coagulated fluid after it has passed over the body, which it appears to do, for it may often be seen covering the orifice, but that the opening is more or less connected with the lacunar portion of the body-cavity, through which similar mucous excreta pass away. It is probably homologous to the canals and orifices in the foot of *Haliotis* and other genera; or may it not be analogous to the water vascular system of the *Turbellaria*? However this may be, it is a form of development on which there is much to be studied and cleared up.

The generative organs (Plate XXVII. fig. 1 *d*) are as in *M. indica* (compare Plate XVIII. fig. 6), the spermatheca being longer than in that species and the cæcum calciferum is not so well developed; ovo-testis not seen. Penis (fig. 1 *d*, *P*): the cæcum calciferum is represented by a short rounded gland (*K*) close to the junction of the vas deferens; amatorial organ (*D*) very large and cylindrical; spermatheca (*Sp*) very long, reaching nearly to the albumen-gland; intestine, the salivary gland (Plate XXVII. fig. 1 *c*) is elongate, bifurcating at the anterior end, where the two ducts to the buccal mass are given off.

The teeth of the radula (Plate XXVII. fig. 1 *b*) are arranged thus—

$$\frac{35 \,.\, 3 \,.\, 15 \,.\, 1 \,.\, 15 \,.\, 3 \,.\, 35}{53 \,.\, 1 \,.\, 53}$$

and are also similar to *M. indica*, the median being all tricuspid, but are far more numerous, there being six more on either side of the central tooth, not including the two teeth of transitional form; the outermost bicuspid laterals are also longer, with one point, the inner, exceeding the outer throughout. The jaw (fig. 1 *a*) has the central projection on the cutting-edge, but is not so curved in form.

It will thus be seen that these two species of *Macrochlamys* are

similar in all important characters, the departure being exhibited in the shell and dorsal lobes of the mantle, *M. atricolor* possessing no tongue-like process to the left shell-lobe overlapping the edge of the shell, while the left dorsal lobe is divided into two parts, of which the posterior is nearly detached from the anterior portion. Other forms share these differences, but more species must be examined before creating a subgeneric title.

I have examined two specimens of this species, one from Kopamedza Peak, Naga Hills, which agree perfectly in the form of the teeth.

Macrochlamys atricolor, var. (Plate XXIV. fig. 3.)

Locality. Munipur Hills and Burrail range.

Shell narrowly perforate, subglobosely conoid, solid; colour olivaceous, ochaceous below; spire subconoid, sides flatly convex; suture shallow; whorls 5, last well rounded, globosely lunate, subvertical; columellar margin very oblique.

Size: maj. diam. 20·5, min. 18·5; alt. axis 9·0, body-whorl 7·0 mm.
„ 0·81, „ 0·73; „ 0·36, „ 0·28 inch.

This form from the highest ranges is smaller and more globose than others.

Macrochlamys atricolor, var.

Locality. Kopamedza Peak, Burrail range.

Shell scarcely perforate; colour ochraceous with a greenish tinge, a band of stronger ochre colour near peristome; whorls 5.

Size: maj. diam. 18·0, min. 16·0; alt. axis 7·4, body-whorl 6·0 mm.
„ 0·71, „ 0·63; „ 0·29, „ 0·24 inch.

This is again a smaller form, similar to the last in every respect.

Macrochlamys atricolor, var. juv.

Locality. Hengdan Peak.

This is evidently a young shell of *M. atricolor*, var., from Kopamedza. Sculpture very smooth and glassy, with irregular, indistinct, micro-striation longitudinal; colour fine olive-brown, with a sienna band near the aperture; whorls 4.

Size: maj. diam. 10·5, min. 9·2; alt. axis 4·5, body-whorl 3·3 mm.
„ 0·41, „ 0·36; „ 0·18, „ 0·13 inch.

Macrochlamys atricolor, var. (Plate XXIV. fig. 5.)

Locality. Hatoue, Khakhyen Hills, Upper Burmah (*Dr. J. Anderson*).

Sculpture perfectly glassy on surface, without slightest sign of striæ.

Nevill, in the "List of Mollusca brought back by Dr. J. Anderson from Yunnan and Upper Burmah," J. A. S. B. 1877, p. 16, identifies this species with *M. resplendens*, Phil. A comparison of fig. 5 with that of fig. 1, Plate XXVI. of this work, from the typical locality Mergui, collected by Mr. Theobald, will show how greatly they differ

in form; and I possess three specimens from Upper Burmah out of the Indian collection. Nevill says, "This species was found abundantly at Bhamô and in the second defile of the Irawady. The specimens are quite undistinguishable from others in the Museum from Mergui (typical locality). I think it doubtful if Godwin-Austen's *N. atricolor* from the Shisha valley will prove really distinct." The closely wound whorls, their greater number, and the flattened form of *M. resplendens* are very distinct characters, and these two forms cannot be confused. "Shisha valley" (*l. c.*) is an error of copying or printing: there is no such place.

Size:	maj. diam. 21·8,	min. 19·0;	alt. axis 9·5,	body-whorl 8·8	mm.
	,, 0·86,	,, 0·75;	,, 0·37,	,, 0·35	inch.

More globose and tumid than the typical specimens from Munipur and the Naga Hills.

MACROCHLAMYS ATRICOLOR.

Locality. Toruputu Peak, Dafla Hills. (Plate XXIV. fig. 4.)

Shell, umbilicus very narrow, almost concealed, subglobosely conoid; sculpture smooth, glassy surface, with indistinct longitudinal lines on last whorl, not apparent on the apical portion; colour pale olivaceous brown; spire moderately high, apex blunt; suture well defined; whorls 5, convex, the last well rounded and rather ventricose; aperture moderately thin, subvertical; peristome broadly lunate, horizontal at base, slightly sinuate and oblique near columellar.

Size: maj. diam. 19·0, min. 16·8; alt. axis 8·4, body-whorl 6·4 mm.

Very similar to specimens from Munipur.

MACROCHLAMYS CACHARICA, n. sp. (Plate XXVII. fig. 2.)

Locality. Munipur Hills.

Shell subperforate, very depressedly conoid and flat on the base, thin, glassy; sculpture none save transverse striæ of growth; colour pale sienna-brown; spire flatly conoid, apex subacute; suture moderately impressed; whorls 5, regularly increasing; aperture subvertical; peristome thin, sinuate below; columellar margin weak, oblique, non-reflected.

Size:	maj. diam. 18·8,	min. 17·3;	alt. axis 7·0,	body-whorl 5·7	mm.
	,, 0·74,	,, 0·68;	,, 0·28,	,, 0·23	inch.

This shell may be distinguished from *M. atricolor* of same size by its flatter base and less rounded apex.

The animal is, as regards its outward form, exactly as in *M. atricolor*; but the generative organs (Plate XXVII. fig. 2 *c*) are modified. The male organ is like that of *M. indica* with a longer kalc-sac, and the spermatheca is short and club-shaped with a rounded terminal portion. There is, however, no amatorial organ, and I have examined four specimens. Another instance of its absence in certain species is exemplified in *Durgella*, a point that has been noticed by Stoliczka. The jaw (Plate XXVII. fig. 2 *a*) is slightly convex on the upper margin, still more so on the cutting-edge, with a large

central projection; the odontophore (fig. 2 *b*) differs materially from *M. atricolor* and *M. indica*.

38 . 2 . 12 . 1 . 12 . 2 . 38
52 . 1 . 52

The central tooth is tricuspid, of usual form; the median teeth are bicuspid, the smallest cusp being situated on the outer lower margin, the inner (conspicuous in the above species) being absent; the laterals are bicuspid, with points rising equally.

Here we are presented with a form which outwardly cannot be distinguished from its close neighbour *M. atricolor*, but in its anatomy presenting considerable divergence both in generative organs and dentition, really quite marvellous are the modifications which are presented in this group of shells. So many combinations of the various characters are found as we look more closely into the different species, that these are better shown in a tabular form, which I am preparing.

Macrochlamys cacharica, var. glauca. (Plate XXIV. fig. 6.)

Locality. Harmutti, base of Dafla Hills, Assam.

Shell perforate, depressedly conoid, base flat; sculpture, very smooth surface, no striation seen; colour very pale greenish ochre; spire low; whorls 5; aperture subvertical; umbilicus rather open.

Size: maj. diam. 22·8, min. 19·8; alt. axis 8·0, body-whorl 7·8 mm.
,, 0·87, ,, 0·76; ,, 0·32, ,, 0·31 inch.

The shells from the above locality are rather more tumid than the typical specimens from the Cachar side.

Macrochlamys? lubrica. (Plate XXIV. fig. 7.)

Helix lubrica, Benson, A. M. N. H. vol. x. p. 349 (Nov. 1852); Pfr. Mon. Hel. vol. iv. p. 44; Reeve, Con. Icon. pl. clxxi. fig. 1153; Conch. Ind. p. 24, pl. li. figs. 8, 9.

Nanina lubrica, Gray, Cat. Pulm. B. M. p. 42; H. & A. Adams, Gen. ii. p. 223.

Macrochlamys (sec. A) *lubrica*, Theob. Cat. Supp. p. 18.

Nanina (*Macrochlamys*?) *lubrica*, Nev. Hand-list, p. 22.

Nanina (*Xesta*) *lubrica*, Pfr. Malak. Blätt. 1855, p. 120.

Locality. Darjiling, N.E. Himalaya.

Sculpture none, a perfectly smooth surface; colour very rich ochre-brown.

Size: maj. diam. 26·7, min. 22·3; alt. axis 10·0, body-whorl 8·5 mm.
,, 1·1, ,, 0·88; ,, 0·40, ,, 0·34 inch.

Original description:—"*Testa perforata, depressa, obsolete radiato-striata, politissima, luteo-fulvescente vel olivacea; spira planiuscula, apice vix prominulo, obtuso, sutura leviter subcanaliculata. Anfractibus 5, ultimo rotundato, basi convexo; apertura late lunari, vix obliqua, peristomate acuto, intus interdum subremote albido-labiato, margine*

columellari oblique descendente, subsinuato, leviter incrassato, superne reflexiusculo.

"Diam. major 24, minor 20, axis 11 mill.

"*Hab.* ad Darjiling."

"Distinguished by the proportion of the whorls and other characters from *H. resplendens*, Philippi, and from *H. vitrinoides* also by the greater depth of the last whorl, and the characters of the mouth. I have long possessed the pale-coloured variety from Darjiling; the acquisition of a second dark-coloured specimen from Mr. Trotter has confirmed the distinctness of the species."

MACROCHLAMYS KOLIAENSIS, n. sp. (Plate XXVI. figs. 5, 5 *a*.)

Locality. Koliaghur, on Brahmaputra river, Assam. (Young specimen.)

Shell umbilicated, smooth, transparent, shining, very depressedly conoid; sculpture none; colour horny brown with an olive tinge; spire very low; suture adpressed; whorls 5, rather rapidly increasing, last rounded on side and tumid below; aperture subvertical, ovately lunate; peristome thin, oblique on columellar margin.

Size: maj. diam. 12·0, min. 10·4; alt. axis 4·7, body-whorl 3·7 mm.

Animal (extract from Field-book). "Dusky green, side of foot grey, spotted with sienna; extremity of foot with gland, having an overhanging lobe long and pointed; mantle just overlaps the edge of the aperture." On dissection of dried specimen we find a long slender right shell-lobe on the upper inner margin, and a small left shell-lobe also could be made out.

The generative organs are as in *Macrochlamys indica*, the amatorial organ being present, having a blunt rounded termination at the anterior end.

The central tooth of the radula of usual tricuspid form, the median have only the lower denticle on the outer basal margin; the laterals are bicuspid cusps of unequal length even to those on the outer margin, which become very small. There were 93 rows of teeth arranged thus (*vide* Plate XXVIII. fig. 3):—

$$\frac{42 \;.\; 2 \;.\; 10 \;.\; 1 \;.\; 10 \;.\; 2 \;.\; 42}{54 \;.\; 1 \;.\; 54}$$

The jaw was straight on the cutting-edge, with a central median projection.

Sculpture regular, longitudinal coarse striæ, broadly ridged (Plate XXI. fig. 7); odontophore with straight unicuspid laterals.

MACROCHLAMYS CASTANEO-LABIATA, G.-A. (Plate XXIX. fig. 2.)

Locality. Asalu, Burrail range, Assam.

Shell perforate, depressedly conoid, flat below, surface shiny, with fine transverse lines of growth, translucent, moderately solid; sculp-

ture regular, longitudinal, rather coarse striæ, broadly ridged; colour pale horny brown, with a pale ochraceous, more or less wide margin at the peristome (in the largest specimens a former aperture is still shown by a band of colour across the whorl); spire flatly conoid, apex obtuse; suture shallow; whorls 6, regularly increasing, the last somewhat swollen below; aperture broadly lunate, suboblique; peristome acute, slightly curving outward above and slightly sinuate below; columellar margin very oblique from umbilicus, and scarcely reflected.

Largest size:

Maj. diam. 15·8, min. 13·8; alt. axis 6·8, body-whorl 5·8 mm.

Smaller size:

Maj. diam. 13·2, min. 11·8; alt. axis 6·0 mm.

This shell was very abundant at Asalu, especially in the old (jooms) forest-clearings; it occurred also on the peak of Hengdan, one of the highest points in this part of the Burrail range: from this locality it is somewhat smaller, paler and whiter in colour, perhaps due to the dark forest-home. These measured 12·2 × 10 × 5·2 mm. and 11·2 × 10·3 × 4·8 mm.

On Japoo Peak, 10,000 feet, another small variety was found, but all having the distinctive pale-margined lip. I have a fine example also from Rezameh in the Naga Hills (16·0 × 13·7 × 7·3 mm.) (Plate XXIX. fig. 3), which is rather more globose in form.

Animal. Head and tentacles dark grey, underside of foot with two narrow black lines.

MACROCHLAMYS CASTANEO-LABIATA, G.-A. (Plate XXIX. figs. 1, 1 *a*.)

Locality. Munipur Hills (*Mr. J. Ogle*).

Size: maj. diam.	18·3,	min. 15·5;	alt. axis 7·0,	body-whorl 5·5	mm.
,,	0·72,	,, 0·61;	,, 0·28,	,, 0·22	inch.

Specimen figured from Asalu (Plate XXIX. fig. 2):—

Size: maj. diam.	14·8,	min. 13·3;	alt. axis 6·0,	body-whorl 5·0	mm.
,,	0·58,	,, 0·53;	,, 0·24,	,, 0·20	inch.

Specimen from Rezameh, Naga Hills:—

Size: maj. diam.	16·0,	min. 14·2:	alt. axis 6·8,	body-whorl 5·0	mm.
,,	0·63,	,, 0·56;	,, 0·27,	,, 0·20	inch.

The above specimen, sent me in spirit by Mr. Ogle, from the high hills between Cachar and Munipur, was evidently, when living, very dark in colour, with perfectly black head and tentacles. The right shell-lobe extremely long (Plate XXIX. fig. 4), as well as the left shell-lobe, which must be extended over the basal part of the shell; the neck-lobes as in *M. indica*; the jaw and odontophore are, however, quite different.

The generative organs (Plate XXIX. fig. 7) may be compared with those of *M. indica* (Plate XVIII. fig. 6). The male organ has only a blunt swollen portion near the junction of the vas deferens,

indicating the kalc-sac, and the amatorial organ is large and terminating in a blunt rounded form.

Odontophore. The radula (figs. 6 *b*, 6 *c*) is about 2·75 mm. long, with about 82 transverse rows of teeth; the median are all considerably larger than the laterals; the centre tooth is tricuspid, as well as the next 8 median teeth; the next (that is the 9th and 10th) have only a single cusp on the outer margin, and all the succeeding laterals are simple, elongate, straight teeth, becoming small on the edge of the labial ribbon.

45 . 2 . 8 . 1 . 8 . 2 . 45
55 . 1 . 55

The jaw (fig. 5) is straighter than in other species of this genus, the centre projection being on a level with the portion on either side; it is longitudinally striate and about 1·2 inch in breadth. Fig. 6 *a* gives a central tooth and first median on either side of a specimen in which the former is unsymmetrical as regards the cusps at the base; and this malformation continued the whole length of the radula. Such malformation occasionally occurs in one of the set; and whatever form it may assume, it necessarily is always repeated in each row. In this odontophore we find another departure from *Macrochlamys*, the laterals being like those of *Ariophanta* and *Oxytes.*

Shells rather large, globose or depressedly conoid; sculpture decussate or papillate; longitudinal striæ, crossing fine transverse ribbing.

MACROCHLAMYS DALINGENSIS, n. sp. (Plate XXXV. figs. 1, 1 *a*.)

Locality. Damsang, Daling Hill, Western Bhutan (*W. Robert*).

Shell, perforations somewhat concealed, subdepressedly conoid, base rather flat; sculpture slender, under high power papillate (fig. 2, × 50), the longitudinal striation crossing coarser but fine ribbing and breaking it up; this is again arranged in transverse bands of growth; colour dark umber-brown, with a pinkish broad margin bordering the peristome; spire flatly conoid, apex obtuse; suture rather shallow; whorls 6, rather closely wound near the apex; aperture oblique, ovate; peristome somewhat thickened, milky white just within it; columellar margin oblique and but slightly reflected.

Size: maj. diam. 24·2, min. 21·0; alt. axis 10·5, body-whorl 8·2 mm.
„ 0·95, „ 0·83; „ 0·42, „ 0·32 inch.

Among Stoliczka's drawings is one (No. 46) of a Darjiling shell of a dark brown colour, with a ruddy band near the peristome, the animal having a very conspicuous long horn above the foot-gland and right and left shell-lobes, the latter well in front; it is no doubt this species, although slightly smaller, and a near ally of *M. tugurium.* No. 21 of the same set of drawings represents another umber-coloured shell, with edge of peristome coloured, of same size

as *M. dalingensis*, but no shell-lobes are visible, and the horn above the mucous pore is unusually well developed. Stoliczka wrote "*lubrica?*" below this; Nevill "*mainwaringi?*" and on the other drawing "*mainwaringiana*." No. 21 is also the species referred to in Nevill's Hand-list, p. 49, no. 272, *Nanina* (*Bensonia*?), n. sp., with this note:—"Perhaps better classed near *N. tugurium*. From a drawing of Dr. Stoliczka's the animal appears to be of a brick-red colour, with a pointedly truncate tail and remarkably developed nearly vertical horn above. 20 sp. Darjiling. Coll. Dr. F. Stoliczka and Colonel G. B. Mainwaring." There is some uncertainty about Nevill's MS. title *mainwaringi*, and I therefore do not retain it, but think it better, so as to avoid any future confusion, and as my specimens include the animal which I also describe, to give it the above name *dalingensis*. I have a fine specimen of Mr. Nevill's *mainwaringi* received from him, and although no doubt belonging to this group, it differs very much in colour and form. I shall figure it with *tugurium* and other shells in some future part.

The animal (figs. 3 and 4) is pale coloured in the spirit-specimens. The right shell-lobe is present though not very large, and there is a left shell-lobe (figs. 4 and 5) on the anterior left margin of the peristome, thus not quite so far back as in other forms. The left dorsal lobe is divided into two parts, and the posterior (fig. 4) is narrow and pointed behind, showing an interesting approach towards the more reduced form of the same lobe in *Oxytes cycloplax* (Plate XXXI. fig. 4) and *orobia* (Plate XXXII. figs. 1, 1 *a*, 1 *b*); the anterior portion is well developed. The extremity of the foot presents a different formation, and even in the spirit-specimen is still long; the ridge of the foot behind extends quite to the point, running up between the extended pedal margin; the gland is linear and just reaches to the sole of the foot, which is of normal form.

Generative organs (fig. 9). These do not call for any detailed description, being very similar to *M. indica*; the kalk-sac is moderately long, the amatorial organ slender and pointed near the muscle-attachment; the hermaphrodite duct much convoluted.

Odontophore. The central and laterals (figs. 8, 8 *a*) as in type of genus, but the laterals are more numerous and diminish in size into very small teeth on the outer edge (fig. 8 *b*).

45 . 2 . 14 . 1 . 14 . 2 . 45
61 . 1 . 61

The laterals are bicuspid at first, with the inner point the longest, but pass outwards into almost unilateral teeth, showing only a slight notch near the point.

The salivary glands are in one mass; the œsophagus and intestine are of same size throughout (fig. 10).

Genus Oxytes, Pfeiffer.

This was indicated with its type *Nanina oxytes*, Benson, in section vi. of true *Helices* (without description). The animal of this species presents some good characters sufficiently distinctive, and also common to other species in the Indian region. It forms therefore a good well-marked group, resting on a better basis than many of these subgenera. The modification of the mantle-lobes and its very different dentition mark it as a distinct subgenus.

Oxytes, Pfeiffer, Zeits. Malak. 1856, p. 138 (synopsis of species); Mon. Hel. vol. iv. (1859) p. 2.

Hemiplecta, sec. D, Theob. Supp. Cat. p. 22.

Nanina (*Hemiplecta*), in part = *Oxytes*, Nevill, Hand-list, p. 46.

Oxytes, Albers, Heliceen, ed. v. Martens (1860), p. 54; Godwin-Austen, J. A. S. B. 1880, p. 157.

Genus *Nanina*, sec. *Oxytes*, Pfr. ed. Clessin, Nomen. Helic. 1881, p. 54.

Mr. W. Robert's collection from Darjiling enables me to give a fuller account of this genus and its anatomy.

Description of the Genus. (Plates XXX., XXXI., & XXXII.)

Animal: tentacles short and rather thickened; the mucous gland or foot-gland with no marked horn above, therefore as in *Ariophanta*, but the slits extending to the sole of the foot. *Mantle*: the right dorsal lobe is, as usual, triangular and well developed (Plate XXXI. fig. 2, Plate XXXII. fig. 1 *a*); the left dorsal is in two parts, the anterior large, the posterior very small (Plate XXXI. fig. 4, Plate XXXII. figs. 1, 1 *a*, 1 *b*), giving off short tongue-shaped processes, right and left or upwards, which may be compared with the similar reduced posterior lobe of *Macrochlamys atricolor* (Plate XXV. figs. 3, 4, and 8); the left shell-lobe is a narrow ribbon reflected over the peristome; there is no right shell-lobe. *Generative organs*: the hermaphrodite duct is peculiarly long, and composed above of two distinct ducts (Plate XXXII. fig. 5, ? the ♂ and ♀); the male organ has a short spindle-shaped kalk-sac (fig. 5 *b*) with a large coiled cæcum where the retractor muscle is given off, and which may be a sort of secretory sac for the development of the spermatophore; the amatorial organ is present. *The odontophore*: this is very characteristic; the central teeth are long, straight, with no side cusps, or these are just indicated; the laterals are also simple, straight, unicuspid teeth; the jaw has the central projection; the radula and foot-gland in this genus assimilate with those of *Ariophanta* on one side, the left dorsal lobes to *Macrochlamys* (as seen in *atricolor* only) on the other.

Shell. Generally of large size, perforate or openly umbilicated, dextral, somewhat depressed above, rounded below, some sharply keeled; whorls regularly wound, sides flat above, suture linear or very shallow.

The following species are included in this genus:—

OXYTES OXYTES, Benson. (Plate XXX. figs. 2, 2 *a*; animal, figs. 3, 3 *a*, 3 *b*, from Cachar.)

Helix oxytes, Benson, J. A. S. B. 1836, vol. v. p. 351; Pfr. Mon. Hel. vol. i. p. 395; Reeve, Conch. Icon. f. 734; Conch. Ind. p. 13, pl. xxvi. fig. 1 (with the misleading general locality "Bengal," and the keel shown far too broad and coarse).

Hemiplecta (sec. D) *oxytes*, Theob. Cat. Supp. p. 22.

Nanina (*Hemiplecta*) *oxytes*, Nev. Hand-list, No. 261, p. 47. "No projection above the gland, which is rather broad; sole broadly margined and with a double line (*W. T. B.*)."

Locality. S.W. Khasi (*H. H. G.-A.*).

This is a very abundant shell on the outer lower slopes of the Darjiling and Western Bhutan Mountains, as well as of the Khasi and Garo Hills. In the limestone rocks south of the latter districts it grows into a superb shell, solid, and more depressed above, the whole form so altered that it might be taken for another species. Shells in every stage of development can be found, and their larger size is due to the excessive moisture, abundance of food, and the character of the rocks, undermined and hollowed out by the drip from the forest trees, so that the land-shells have most secure quarters to retire to, and thus live much longer than in more open situations. The land Mollusca are more prolific also in such ground; notably near Nongkulang and Yindku, in the S.W. Khasi Hills, their dead shells strew the ground on every side.

The large variety of *O. oxytes* is figured on Plate XXX. figs. 1, 1 *a*; it measures—major diam. 56·5, minor diam. 50·0, alt. axis 16·5 mm. I found *O. oxytes* also in the Dafla Hills, similar to Darjiling specimens; and in the North Cachar Hills I obtained fine examples.

The animal figured is from Stoliczka's series of drawings (No. 36), made from a specimen sent by me to him from Cachar.

Original description:—"*T. late umbilicata, orbiculari, depressa, oblique subplicata, ferrugineo-cornea, spira convexa, apice planato; anfractibus* $5\frac{1}{2}$, *subplanatis, contabulatis, ultimo carinato, subtus tumidiusculo; sutura vix marginata; apertura subquadrato-lunata, valde obliqua, intus albida, polita, marginibus acutis expansiusculis, callo tenui junctis, inferiore valde arcuato, subreflexo; umbilico lato, profundo, omnes anfractus exhibente, margine subcompresso.*

"Diam. major 47, minor 40, axis 15 mill.

"*Hab.* in montibus præter fines provinciæ Bengaliæ orientales versus septentrionem spectantes."

The following is the description of the animal of a specimen from Moyong in the N. Khasi Hills:—Dark coloured, the eye and oral tentacles very dark neutral grey; extremity of foot rounded, with a wide open gland above; the foot is also short and flattened.

The next species is a very close ally.

OXYTES CYCLOPLAX, Bs.

Helix cycloplax, Benson, A. M. N. Hist. vol. x. p. 348 (1852); Reeve, Conch. Icon. *Helix*, f. 1156; Pfr. Mon. Hel. vol. iv. p. 181; Conch. Ind. p. 13, pl. xxvi. fig. 7.

Hemiplecta (sec. D) *cycloplax*, Theob. Cat. Supp. p. 22.

Nanina (*Hemiplecta* ?) *cycloplax*, Nevill's Hand-list, p. 48.

Oxytes cycloplax, Godwin-Austen, J. A. S. B. 1880, p. 157.

Locality. Daling Hills near Darjiling (*W. Robert*). (Plate XXXI. fig. 1, juv.)

A mature shell is figured from a fine specimen in Mr. W. T. Blanford's collection (figs. 8, 8 *a*, 8 *b*); it measures—major diam. 36·0, minor diam. 31·0, alt. axis 11·0 mm. The anatomy is that of the specimen fig. 1, which shows the coloured band. The generative organs (Plate XXXI. fig. 7), mucous gland, and mantle-lobes (figs. 2, 3, 4) are similar to *O. orobia*, as described further on (p. 129). The central teeth of the radula are elongately triangular and straight-sided in form, the laterals slightly curved, straight unicuspid teeth; the formula is

$$\frac{26 \;.\; 11 \;.\; 1 \;.\; 11 \;.\; 26}{37 \;.\; 1 \;.\; 37}$$

The figure in 'Conch. Indica' is very rough, and no basal view of either this or *oxytes* is given to show the open umbilicus. I therefore give additional figures of these two species.

Original description :—"*Testa late umbilicata, orbiculato-depressa, supra confertim et undatim radiato-striata, striis spiralibus decussata, granulata, rufescenti-cornea, subtus leviore pallida, fascia mediana castanea circumdata ; spira convexiuscula, apice planato, sutura obsoleta, demum impressa. Anfractibus 5, planatis, ultimo subcarinato (ætate juvenili acute carinato) antice dilatato, prope suturam antice tumidiusculo, subtus tumido. Apertura subquadrato-lunari, obliqua, intus interdum albido sublabiata, peristomate simplice, acuto, margine columellari non reflexo, cum basali angulum obtusatum formante. Umbilico profundo, perspectivo.*

"Diam. major 42, minor 34, axis 17 mill.

"*Hab.* ad Darjiling, Himalayæ Sikkimensis montem. Teste R. Trotter.

"I am indebted for this fine and interesting shell to Mr. Robert Trotter, of the Bengal Civil Service, who collected it, with some other new shells, during a short visit to the Sanatarium of Darjiling, together with a single specimen of the scarce *Helix orobia*, nobis, and some *Cyclostomata* previously described. Darjiling is situated at an altitude of more than 7000 feet above the sea-level.

"The shell is nearly related to *H. oxytes*, nobis, an inhabitant of the mountain group south-east of the Burhampooter river ; but it is at once distinguished from it by its sculpture, less acute periphery in the adult, the formation of the last whorl anteriorly, the more tumid base, &c."

Oxytes castor, Theobald. = *O. pollux*, var. *cherraensis*, W. Blf.

Helix castor, Theob. J. A. S. B. 1859, vol. xxvii. p. 319; Hanley, Conch. Ind. p. 13, pl. xxvi. fig. 3 (Nanclai), Khasi Hills.

Hemiplecta (sec. D) *castor*, Theob. Supp. Cat. p. 22, = *cherraensis*, Blf.

Nanina (*Hemiplecta*?) *castor*, Nevill, Hand-list, p. 48. no. 263, = *cherraensis*, Blf.

Oxytes castor, Godwin-Austen, J. A. S. B. 1880, p. 157.

Original description:—"*Testa lenticulari, subdepressa, vix umbilicata, acute carinata, confertim striata ferrugineo-fusca; anfractibus* 5½–6; *magnitudinis* 1·40–1·60.

"*Habitat* apud Nanclai, 'Nongklai?' in montibus 'Khasia' dictis.

"This shell is not common, and I have only a barely adult specimen in good condition. . . . . . The keel, too, is a trifle more acute and divides the body-whorl in a symmetrical manner, from the shell not being so flattened down as in *H. oxytes*. The shell is rather stout, and the peristome probably thickened more or less."

I have lately seen, for the first time, the type specimen of *O. castor* in Mr. Theobald's collection, and compared it with shells in my own collection, and I am able to state that it is the var. *O. cherraensis* of Mr. Blanford. I give his original description, as it is more detailed than that of *O. castor*. The peristome is not thickened in the adult shell.

Oxytes pollux, var. cherraensis, W. Blf.

Oxytes pollux, var. *cherraensis*, W. Blf. J. A. S. B. vol. xxxix. 1870, p. 14, pl. iii. fig. 8.

Helix cherraensis, Hanley, Conch. Ind. p. 13, pl. xxvi. fig. 6 ("very closely allied to, if, indeed, distinct from *H. castor*").

This is only a variety of *Oxytes pollux* found in the deep valley east of and below Cherra Poonjee.

Mr. Blanford remarks, "I should not have distinguished this shell from *N. pollux*, Theobald, had not Major Godwin-Austen assured me that the animal is totally different from that of the shell described above. It is distinguished by its higher spire, darker colour, and by the more marked spiral striation." I have six specimens, all of a ruddy umber-brown, with coarser sculpture when compared with specimens from Nongkulong, in the S.W. Khasi Hills, which are pale ochraceous and far smoother. The following note was made of the animal:—"Of a brown-pink, the pink very rich towards the extremity of the foot; tentacles long, 0·65, oval, well developed."

My largest specimen measures:—

Major diam. 35·5, minor 32·5, alt. axis 12·0 mm.
,, 1·40, ,, 1·28, ,, 0·48 inch.

Original description:—*Testa perforata, depressa, acute carinata, lenticularis, tenuis, nitidula, castaneo-cornea, striis incrementi et lineis*

minutis spiralibus undique confertim decussata; spira depresso-conica; apice obtuso; sutura linearis. Anfr. 6, *intus convexiusculi, extus planulati, ultimus juxta carinam compressus, subtus convexus, non descendens. Apertura obliqua, angulato-lunaris; peristoma tenue, margine basali leviter undulato, columellari juxta perforationem vix reflexo.*

"Diam. maj. 32, min. 29, axis $13\frac{1}{2}$ mm.

"*Hab.* ad Cherra Púnji in montibus Khasi (*Godwin-Austen*)."

OXYTES POLLUX, Theobald.

Helix pollux, Theobald, J. A. S. B. 1859, vol. xxvii. p. 319; Blanford, J. A. S. B. 1870, vol. xxxix. p. 13; Hanley, Conch. Ind. p. 13, pl. xxvi. figs. 2–5.

Hemiplecta (sec. D) *pollux*, Theob. Supp. Cat. p. 22.

Nanina (*Hemiplecta*?) *pollux*, Nevill, Hand-list, p. 48. no. 264, pl. xi. fig. 4.

Oxytes pollux, Godwin-Austen, J. A. S. B. 1880, pp. 157, 158.

Original description:—"*Testa lenticulari, subdepressa vix umbilicata, acute carinata, tenue striata, translucente, colore stramineo, polita, peristomate acuto; anfractibus* $5\frac{1}{2}$–6; *magnitudinis* 1·40–0·55.

"*Habitat* prope Teria ghât, ad pedem montium Khasia dictorum.

"This shell is a very distinct species, of the same form as the above, from which it differs in sculpture, want of solidity, and colour.

"As far as I can judge, its habits are arboreal, whilst the last species affects rocks in company with *H. oxytes*."

OXYTES POLLUX, var., Theobald.

Oxytes pollux, var., W. T. Blanford, J. A. S. B. 1870, vol. xxxix. p. 13.

Original description:—"*Testa perforata, depressa, lenticularis, acute carinata, tenuis, cornea, nitida, striatula, lineis spiralibus minutissime sub lente, fere obsolete decussata. Spira depresso-conica; apice obtuso; sutura linearis. Anfr.* $5\frac{1}{2}$, *intus convexiusculi; extus concaviusculi et colore saturatiore, ultimus juxta carinam compressus, subtus convexus, non descendens. Apertura oblique angulato-lunaris; peristoma tenue, marginibus callo tenui junctis, basali leviter undulato, juxta perforationem vix reflexo.*

"Diam. maj. 30, min. 27, axis $11\frac{1}{2}$ mm.

"*Hab.* Nongkulong et Habiang in montibus Khasi (*Godwin-Austen*).

"This appears to me a variety of Mr. Theobald's species, differing only in the last whorl being a little narrower. Mr. Theobald's type, of which I have a specimen, is from Teria Ghat on the south side of the range. Major Godwin-Austen's specimens are from the north side."

Nongkulong is on the south side of the range and about forty miles to the west of Cherra Púnji. I had been surveying also on the north of the range, and had forwarded many shells from there,

and this may have led Mr. Blanford to think the locality on that side. The animal is thus described in my note-book:—"Pale light yellowish ochre. Head rather darker. Eye-tentacles rather thick at the base and long. Extremity of foot and lower part of the body very light, short, flat, and rounded behind, with a gland; underpart of foot with a dark furrow; slight colour at extremity of foot. The shell is pale yellowish green; older specimens pale grey, with an ochraceous tint."

These two species *castor* and *pollux* are very closely allied, and can only be considered varieties—*castor*, first described, being the typical form, though *pollux* is the most abundant.

I have been able to soak out the radula of a specimen from Nongkulong. It is similar to that of *O. cycloplax* and *orobia*, nearest to the latter; the laterals perhaps rather longer and more numerous.

Oxytes blanfordi, Theobald.

Helix blanfordi, Theob. J. A. S. B. 1859, vol. xxvii. p. 308; Pfr. Mon. Hel. vol. v. p. 113; Hanley, Conch. Ind. p. 27, pl. lx. figs. 1, 2, 3.

Hemiplecta (sec. D) *blanfordi*, Theob. Supp. Cat. p. 22.

Nanina (*Hemiplecta*?) *blanfordi*, Nevill, Hand-list, p. 48. no. 265.

Oxytes blanfordi, Godwin-Austen, J. A. S. B. 1880, p. 157.

Original description:—"*Testa umbilicata, depressa, late, sive costulate striata, exilissime et minutissime flexuose granulata, ad peripheriam undata; ferrugineo-cornea, acute carinata, linea peripheriali tenui albida cincta, ad suturam anfractus ultimi rotunda. Anfract.* 5½, *ultimo circa umbilicum vix perspectivum tumido. Apertura angulate lunari. Perist. acuto ad umbilicum parum dilato, crassiusculo.*

"*Hab.* prope Darjiling. Diam. 0·96, alt. 0·35. A young specimen of *H. cycloplax* measures diam. 0·96, alt. 0·45."

Umbilicus not so open as in *O. oxytes* and *cycloplax*, but more so than that of *O. pollux*.

Oxytes shanensis, n. sp.

Hemiplecta (sec. D)? = *blanfordi*, Theobald, Supp. Cat. p. 22, from Upper Salwin, Shan States.

Locality. Shan States (*Fedden*).

Shell openly umbilicated, depressed, sharply keeled, rather flat below, thin; sculpture fine, transverse, well-marked striæ arranged in about 14 wavy indistinct spiral bands; colour dark ochraceous or pale umber, covered with a thin epidermis; spire depressedly conoid, apex obtuse; suture linear; whorls 5, flat above, the last rather compressed below near the periphery, regularly but rather closely wound; aperture suboblique, semilunate; peristome sharp, curved on lower margin; columellar margin suboblique and but slightly thickened.

Size: maj. diam. 28·0, min. 26·0, alt. axis 7·0 mm.
,, 1·11, ,, 1·03, ,, 0·28 inch.

There are two specimens, unfortunately neither of them fully grown, in Mr. W. T. Blanford's collection. No. 36 of his MS. list unnamed, and with a note "not *N. blanfordi.*" Compared with this last, I note that *blanfordi* has a more contracted umbilicus, and the sculpture is quite different. Compared with *oxytes* it is closer wound, not so flat above, and must, when fully grown, have a greater number of whorls; the umbilicus is not so open and the region round it very differently formed.

This appears to be the species from the Shan States which Mr. Theobald, in his Supp. Catalogue to the 'Conchologia Indica,' identifies as the same as the Darjiling form *blanfordi* mentioned above. There is no doubt regarding its distinctness.

A figure of this species will be given hereafter.

Oxytes orobia, Benson. (Plate XXX. fig. 4.)

Helix orobia, Benson, J. A. S. B. 1848, vol. ii. p. 158; Pfeiffer, Mon. Hel. vol. iii. p. 117; Reeve, Conch. Icon., *Helix*, fig. 738; Hanley, Conch. Ind. p. 14, pl. xxviii. fig. 8; Chemn. ed. ii. *Helix*, n. 886, t. 137. figs. 8, 9.

Hemiplecta (sec. C) *orobia*, Theobald, Supp. Cat.

Hemiplecta orobia, Nevill, Hand-list, p. 48.

Oxytes orobia, Godwin-Austen, J. A. S. B. 1880, p. 157, pl. xi. figs. 1, 1 *a*.

Locality. Darjiling (*W. T. Blanford*).

The animal of this species (Plate XXX. fig. 4) was also figured by me in the 'Journal of the Asiatic Society of Bengal,' from the drawing made under Ferd. Stoliczka's superintendence. I have since obtained a specimen in spirit from Mr. Blanford, which has enabled me to give a few notes on its anatomy; and Mr. W. Robert's recent collections in the Bhutan Hills have given me several more. Although on the general plan of structure of this family, there are some well-marked differences and peculiarities.

The animal (Plate XXXII.) has no right shell-lobe to the mantle; the right dorsal lobe (fig. 1 *a*) is well developed, as is also the anterior portion of the left, although it does not extend very far on the left margin of the peristome; for its posterior portion, lying some distance on the basal side, is small and apparently bilobed (figs. 1 and 1 *b*). The shell-lobe is slightly reflected over the margin of the peristome from the respiratory orifice. The mucous pore at the extremity of the foot is linear, and no horn is developed, though it is represented by a short blunt process (*vide* Plate XXXII. fig 1 *c*).

The ovo-testis is very large, the follicles extremely minute, and it might be taken for a portion of the liver, only that its colour is of a darker brown. The hermaphrodite duct (fig. 5, *h.d.*) is exceedingly long, and much convoluted for its entire length; near the end it divides into two still convolute ducts which lead into the mass of the ovo-testis: it is thus unlike this portion of the generative organs in all other species I have as yet examined, and may indicate the develop-

ment in separate sacs thus early of the spermatozoa and ova. The albumen-gland is covered by the long thin lobes of the liver, is ovoid in form, with one flat side. Oviduct as usual. The spermatheca is buried in its folds and elongately pear-shaped. The amatorial organ is cylindrical, somewhat bent, conforming to the coils of the animal's body, and with the usual muscle-attachment. The penis is very peculiar: at a short distance from the generative aperture it is like a cæcum coiled on itself in a circular or discoid form (fig. 5 *b*), with a short retractor muscle given off from its periphery; it is then free for a short distance to where the *vas deferens* unites with it, and here is an elongate, oval, rather pointed, spindle-like kalk-sac, or *cæcum calciferum.*

Odontophore (fig. 3). Central tooth elongately triangular, broad at base, with two minute denticles on either side; central cusp very pointed; first laterals broad, with a single small blunt tooth on the outer margin at one third its length from the point; tenth and eleventh hardly show a trace of this tooth; and all the remaining laterals are simple, curved, styliform, and gradually decreasing in size.

$$\frac{25 \,.\, 2 \,.\, 15 \,.\, 1 \,.\, 15 \,.\, 2 \,.\, 25}{42 \,.\, 1 \,.\, 42}$$

in 90 rows, and some wanting.

Original description:—"*Testa perforata, depresso-globosa, tenuiuscula, radiatim plicato-striata, striis concentricis granulato-decussata, luteo-cornea, fascia infra peripheriam rufo-fusca ornata, versus apicem rufescente, basi pallidiore; spira rotundata, apice planato; anfractibus* 5½, *superioribus planulatis, ultimo prope suturam tumidiore, peripheria subangulata; apertura subquadrato-lunata, peristomate recto, intus late albido labiato; margine columellari subverticaliter descendente, vix reflexo, perforationem subtegente, angulum cum margine basali expansiusculo efformante.*

"Diam. major 35, min. 31, axis 16 mill.

"*Hab.* Darjiling, regione Sikkim montium Himalayanorum.

"Mus. nost. et Soc. Ind. Orient. Angl. Lond.

"This shell, like *labiata*, *monticola*, and other Himalayan Helices, has frequent varices, the edges of former apertures, distinguished by obliquely radiate bands of a darker colour. It was received by Dr. J. F. Bacon from Darjiling. A specimen from Dr. Pearson is in the East-India Company's Museum in Leadenhall Street."

Oxytes sylvicola, W. Blanford.

Oxytes sylvicola, W. Blanford, J. A. S. B. 1880, vol. xlix. p. 185.

Original description:—"*Testa perforata, depressa, carinata, solidula, oleoso-micans, epidermide crassiuscula obtecta fulva vel luteo-fusca, striis obliquis incrementi atque lineis impressis minutis spiralibus subdistantibus superne decussata (nucleo sublævigata), subtus lævior sed distincte decussato-striata. Spira parum elevata, depresso-conoidea, fere convexa, apice obtuso, sutura lineari, antice vix impressa. Anfr.*

$5\frac{1}{2}$, *sensim accrescentes, primi planulati, ultimi convexiusculi, ultimus haud descendens, subtus convexus, modice inflatus, sed infra carinam, nisi juxta aperturam, leviter compressus. Apertura obliqua, angulato-lunaris, intus livido-albida ; peristoma acutum, intus subincrassato-labiatum, marginibus callo tenui junctis, columellari curvato, breviter reflexo.*

"Diam. maj. 32, min. 29, axis 17 mm. Apert. $16\frac{1}{2}$ mm. lata, $13\frac{1}{2}$ oblique alta.

"*Hab.* In montibus 'Burail Range' dictis, ad alt. 3000–4000 pedum, in provincia 'North Cachar' Bengaliæ orientalis (*H. H. Godwin-Austen*).

"Shell perforate, depressed, carinate, not very thin, having a greasy lustre and a thick epidermis, tawny or yellowish brown, marked with oblique raised striæ of growth decussated by fine, subdistant, spiral impressed lines above (the nucleus almost smooth), and with fainter radiating striæ and concentric impressed lines below. Spire but little raised, almost convex, depressly conoid; apex obtuse; suture linear at first, but slightly impressed near the mouth. Whorls $5\frac{1}{2}$, gradually increasing, the inner nearly flat above, the outer slightly convex, the last not descending, convex and moderately swollen below, but slightly compressed just below the keel, except near the mouth. Aperture oblique, angulately lunate, a little broader than high, pale livid within. Peristome sharp, with a slightly thickened lip inside, the margins joined by a thin callus; columellar margin curved, reflected for a short distance at the perforation. Major diameter 1·26 inch, minor 1·14, axis 0·69, breadth of aperture 0·65, height (measured obliquely) 0·53.

"There is a very remarkable resemblance between this shell and that described by me as *Nanina koondaensis* (J. A. S. B. 1870, xxxix. pt. 2, p. 16, pl. iii. fig. 12), yet I am by no means sure that both belong to the same section or subgeneric group. *N. koondaensis* is an ally of *N. indica* (Pfr.) and *N. shiplayi*, shells doubtless nearly allied to *Hemiplecta*, and very possibly belonging to that subgenus, but hitherto referred to *Rotula* *, or to other sections. *O. sylvicola* is larger, more solid, and covered with a distinct epidermis, and the sculpture is less granulate above, the spiral impressed lines being more distant.

"I have seen but one specimen of *O. sylvicola*, for which I am indebted to Col. Godwin-Austen. Other specimens, I learn, are larger."

On measurement, however, my largest specimen from Kigwemah in the Anghami-Naga Hills is very little larger, being

Major diam. 33·0,	minor 30·5,	alt. axis	15·5 mm.
„ 1·30,	„ 1·2,	„	0·61 inch.

* "Stoliczka, J. A. S. B. 1871, vol. xl. pt. 2, p. 231."

Genus Ariophanta. (Plates XXXIII., XXXIV.)

Ariophanta, Desmoulins, Bull. Soc. Bordeaux, iii. p. 227 (Nov. 1829), pl. i. figs. 1–5; H. & A. Adams, Gen. Rec. Moll. vol. ii. p. 225 (1858); Albers, Die Heliceen, p. 62 (1860); W. T. Blanford (sec. B, as subgenus of *Nanina*), A. M. N. H. 1863, xi. p. 85; Semper, Reisen Phil. p. 50 (1870); Theobald, Supp. Cat. p. 5 (1876); Nevill, Hand-list, p. 18 (1878); Godwin-Austen, Journ. As. Soc. Beng. (1880).

Nanina (*Ariophanta*), Clessin, Nomen. Helic. 1881, p. 54.

Nanina, H. Beck, Index Moll. Mus. Christ. Fred. (1837).

Desmoulins founded this genus on the animal of a specimen sent to him alive by M. Théophile Laterrade in March 1829 from the island of Elephanta, Bombay. The mollusk lived some short time, and two very good drawings of it were made*. Previous to this the shell only had been known, and described by Müller as *Helix lævipes*. To M. Desmoulins (*vide* Part III. p. 78) therefore belongs all the credit of first noticing and distinguishing the very distinct and large group of Asiatic *Helices* possessing a mucous pore at the extremity of the foot, and for which group so characterized he proposed the title Phereporæ, placing the Bombay shell in the above subgenus.

Albers ('Die Heliceen,' p. 62, 1860) defines the subgenus by the shell alone as follows:—"*Testa sinistrorsa, umbilicata, tenuis, diaphana; anfractus ultimus angulatus vel carinatus; apertura obliqua, lunaris, peristoma simplex, acutum, margine columellari reflexo.*" I now describe the animal in more detail, taken from another, but a closely allied, species, *A. immerita*, W. Blf., from Southern India, collected and supplied to me by Colonel Beddome.

Animal. The shell-lobe (Plate XXXIII. figs. 2, 2 *a*, *s.l.*) is a simple narrow band slightly reflected over the peristome; the right dorsal lobe (*r.d.l.*) is divided into two parts, an anterior and a posterior—in this respect as in *Macrochlamys* (*vide* Plate XXV. figs. 8, 9); but the former conceals much more the respiratory and anal orifices. The left dorsal lobe (*l.d.l.*) is simple, in one piece. The mucous pore (figs. 3, 3 *a*) is, as described by Mr. Blanford, "above the flattened posterior extremity of the foot and without a lobe above it." The orifice is a narrow slit which does not reach to the sole of the foot. The pedal line extends up to the lower terminal side of the foot, from the border of which regular oblique grooves are given off. The sole is broad, with a narrow distinct border.

Generative organs (figs. 6, 6 *a*). The penis is short from the junction of the vas deferens; it has a large kalc-sac with a blunt end; the spermatheca correspondingly small. The amatorial organ is present, having a long sharp point or "sagitta amatoria."

Odontophore. The radula (figs. 5, 5 *a*, 5 *b*) is quite distinct from *Macrochlamys* in all the Indian species I have examined: the central

* They are copied in Fig. Moll. Anim. by Maria E. Gray, pl. 288. fig. 7; also by Adams in Gen. Moll. pl. lxxix. figs. 6, 6 *a*.

tooth is tricuspid, the side cusps small and basal; in the median teeth there is only one very small external side cusp, up to the 22nd; the laterals are then curved, uniformly pointed teeth, gradually becoming very small on the extreme margin. The jaw is slightly curved, with a small central projection.

No genus, however, is constant over a large area; and thus we find in the species of *Ariophanta* east of the Bay of Bengal (*A. retrorsa*, Plate XXXIV. figs. 7, 8, 8 *a*) that the radula and jaw are much modified —the central tooth more equally tricuspid, shorter, and all the laterals are bicuspid with even points, the jaw straight in front. I do not, however, possess another specimen in spirit to examine other parts of the anatomy. Professor Semper has, however, examined several species from the Malayan region which he places in this genus (*vide* Reis. Phil. pl. iii. figs. 17–21), viz.:—*rumphi*, v. d. Busch, *martini*, Pfr., *nemorensis*, Müll., *javanica*, Lam., *rareguttata*, Mouss., *striata*, Gray, *atrofusca*, Alb. They all differ very much from the South-Indian form as regards the generative organs, especially in the dart-sac with its large glandular extremity; and as regards the odontophore, in those species (*nemorensis* and *rareguttata*) where the laterals are similar to the Burma form the centrals are unicuspid (*l. c.* plate vii. figs. 6–8). Besides this, some, such as *rareguttata*, have shell-lobes, though generally small, which the Indian species do not possess.

From these differences, all taken together, I consider the above species from the islands of the Malay archipelago to be a distinct group (*vide* J. A. S. B. 1880, p. 153); but as I have not examined them or seen the animals myself, I refrain from giving them any subgeneric title. The sinistral form of the shell counts for very little; for instance, *H. brookei*, which some conchologists have on this single external character placed near this group, possesses no mucous gland, and therefore cannot even be included among the Zonitidæ. It is very interesting though to note that it has a right and left shell-lobe. By Gray this species was placed in *Nanina*, and by Adams in *Rhyssota*. *H. regalis*, Bs., =*vittata*, Adams and Reeve, from Borneo, is another species with a very doubtful generic position, placed in *Ariophanta* by Pfeiffer, in *Nanina* by Adams.

The Indian species of *Ariophanta* are as follows:—

ARIOPHANTA LÆVIPES, Müller. (Plate XXXIII. figs. 7, 7 *a*, white var.; animal, Plate XXXIV. fig. 1, from 57 *b* of Stoliczka's drawings, =*trifasciata*, Chemn.)

Helix lævipes, Müll. Hist. Verm. ii. p. 22. no. 222; Desh. in Fér. Hist. i. p. 177. no. 238; Küster & Chemn. ed. nov. *Helix*, ii. p. 107, t. 84. f. 22, 23, t. 136. f. 12.

Nanina (*Ariophanta*) *lævipes*, Albers, Helic. p. 62.

Helix lævipes, Pfr. Mon. Helic. vol. i. p. 71, vol. iii. p. 75; Conch. Indica, p. viii (not figured).

Ariophanta lævipes, Theob. Cat. Supp. p. 23.
Nanina (Ariophanta) lævipes, Nev. Hand-list, p. 19.
Fér. Hist. Moll. pl. xcii. figs. 3, 5, 6.
Subgenus *Ariophanta*, Desmoulins (var. *a*, all white), from Elephanta.

Description of *H. lævipes* by Benson:—"Helix *testa sinistrorsa, orbiculato-convexa, longitudinaliter rugosa, supra interstitiis rugarum corrugatis, infra transverse rugosulis, tumida, umbilicata ; fulva fasciis plurimis castaneis, majore infra peripheriam; peripheria subangulata ; labro reflexo, albo.*"

Ariophanta trifasciata, Chem. vol. xi. p. 308, t. 213. f. 3018–19.

Helix trifasciata, Küst., Chemnitz, Conch. ed. nov. *Helix*, ii. p. 108, t. 84. f. 20, 21, t. 136. f. 13; Beck, Ind. Moll. p. 5. no. 3; Pfr. Mon. Hel. vol. iii. p. 76.
Helix lævipes, var., Fér. Hist. Moll. pl. 92. f. 4; Conch. Ind. p. 52, pl. cxxxi. f. 4.
Ariophanta lævipes, Desmoulins (vars. *b*, *c*, banded), from island of Elephanta.
Helix lævipes, Fér. Tabl. Syst. p. 41. no. 229; Gmelin, Syst. Nat. p. 3616. no. 222; Chemnitz, Conch. ix. t. 108. figs. 915, 916.

Ariophanta interrupta, Bs., =*himalayana*, Lea. (Plate XXXIV. figs. 2, 2 *a*. Copied from No. 44 of Stoliczka's drawings in Library of Indian Museum. The specimens were from the Botanical Gardens, Calcutta.)

Helix interrupta, Bs. Zool. Journ. vol. v. p. 461 (1832–34); P. Z. S. 1834, p. 90; Pfr. Mon. Hel. vol. i. p. 63, vol. v. p. 122.
Nanina interrupta, Gray, Cat. Pulm. p. 84.
Helix interrupta, Reeve, Conch. Icon. f. 1159; Han. & Theob. Conch. Ind. p. 13, pl. xxvii. f. 3.
Ariophanta interrupta, Theob. Supp. Cat. p. 23; Beck, Ind. Moll. p. 5. no. 4.
Nanina interrupta, Nevill, Hand-list, p. 19.

Description of *Helix interrupta*, Bens.:—"Helix *testa sinistrorsa, orbiculato-convexa, infra tumida, umbilicata, ad peripheriam obtuse angulata, longitudinaliter confertissime striata, supra striis interruptis fasciis transversalibus dispositis, spira apice obtusa; peristomate tenui acuto.*

"*Hab.* in rupibus umbrosis Sicrigali et prope Gangis ostiorum fluvium Jellinghy dictum.

"This shell has been thought to belong to the species called *H. himalayana* by Mr. Lea (*Hel. lævipes*?), but appears to me to be very different when compared with the following characters of a specimen of the latter in my possession."

Benson's description of the animal is brief, and he was mistaken

in the anatomy when he says the excrements are voided from an opening in terminal part of the foot.

Nevill in his Hand-list, from note by W. T. Blanford, states:— "Eggs similar to those of *N. lævipes*, but dull white in colour; length 8–9 mm., diam. about 5; oval longitudinally, deeply sulcated."

The teeth of the radula are similar in every way to those of *A. immerita*, received from Col. Beddome (Plate XXXIII. figs. 5, 5 *a*).

40 . 23 . 1 . 23 . 40
or
63 . 1 . 63

Specimens from Faqirabunda, Jessore district, are thus described in my note-book:—"The animal being of a pink colour the same tint is given to the shell, while black mottlings show through the body-whorl. The head is dark-coloured up to a well-defined black line (extending from the posterior part of the neck to below the oral tentacles), thence light-coloured into a pink tinge, which is more intense near the extremity of the foot. The mucous gland has the form of a long slit with a very small lobe above."

ARIOPHANTA IMMERITA, W. T. Blf. (Plate XXXIII. fig. 1, juv.)

Nanina (Ariophanta) immerita, Blf. J. A. S. B. vol. xxxix. p. 17 (1870).

Ariophanta immerita, Note on Contrib. Ind. Moll. xii. J. A. S. B. 1880, p. 185, pl. iii. figs. 4, 4 *a*.

Helix immerita, Pfr. Mon. Hel. vol. vii. p. 128; Conch. Ind. p. 60, pl. cl. fig. 7.

Ariophanta immerita, Theob. Cat. Supp. p. 23.

Nanina immerita, Nevill, Hand-list, p. 19.

Locality. S. India (*Beddome*).

Shell umbilicated, keeled; sculpture irregular, ribbing broken into a line of raised nipples near the periphery; colour olivaceous brown; a thick epidermis; spire low, rounded, sides quite flat; whorls nearly 4, above flat, rounded below.

Size (not adult): maj. diam. 22·5, min. 20·0, alt. axis 9·5 mm.
,, 0·89, ,, 0·79, ,, 0·37 inch.

Differs from *interrupta* of Lower Bengal in its flatter apex and whorls and in the larger umbilicus.

The generative organs and the odontophore of this species have been sufficiently well described in the diagnosis of the genus (p. 132). The dental formula is as follows (in 78 rows):—

25 . 24 . 1 . 24 . 25
49 . 1 . 49

The animal, when the shell is removed, is beautifully mottled with black over the heart and branchial region. The neck and shell-lobes are very different from what we have seen in *Macrochlamys*

&c. The sole of the foot is not divided into a central area and lateral areas.

The respiratory and anal orifices are situated rather far back near the left neck-lobe.

Original description :—" *Testa sinistrorsa, anguste umbilicata, depressa, sublenticularis, fulvo-cornea, tenuis, oblique striata ; spira parum elevata, conoido-convexa ; apice perobtuso ; sutura vix impressa. Anfr.* $4\frac{1}{2}$, *convexiusculi, ultimus magnus, acute carinatus, carina antice obtusiore, subtus tumidiore, nitidula. Apertura obliqua subsecuriformis ; peristoma tenue, rectum, margine columellari subverticali, reflexo.*

" Diam. maj. 25, min. 21, axis 14 mm. Apertura 13 mm. longa, 11 lata.

" *Hab.* South Canara (*Beddome*).

" This species approaches *N. interrupta*, Bs. (*N. himalayana*, Lea), but has the sculpture finer and not decussated. I have only seen two specimens, one of which is quite young, and it is possible that the one above described is also immature, but there appears no doubt that the form is undescribed. The specimen having been returned to Major Beddome, I am unable to figure it at present."

The same author writes as follows, *l. c.* p. 185 :—" This shell was originally described from an immature specimen, and the same was figured in the ' Conchologia Indica.'

" Subsequently Col. Beddome obtained an adult from the same locality, South Canara. Of this example a figure is not given. The species only differs in sculpture from *A. interrupta*, which is found in various parts of Bengal and Orissa, and has been procured by Col. Beddome as far south as the Golcondah range of hills in Vizagapatam. The two forms replace each other in the eastern and western parts of the Indian peninsula, precisely as do their allies *A. lævipes* and *A. laidlayana*."

ARIOPHANTA ? RETRORSA, A. A. Gould.

Helix retrorsa, Gd. Description of Land-shells from the Province of Tavoy, in British Burma, Boston J. Nat. Hist. vol. iv. (Jan. 1844) p. 455, pl. xxiv. fig. 5 (an excellent figure) ; Pfr. Mon. Hel. vol. i. p. 76 ; Conch. Ind. p. 13, pl. xxv. fig. 6 (viewed from behind).

Hemiplecta (sec. E) *retrorsa*, Theob. Supp. Cat. p. 22, from Tenasserim.

Nanina (*Hemiplecta*) *retrorsa*, Nevill, Hand-list, p. 19, from Moulmain and Mergui.

Original description :—" *Testa orbiculata, sinistrorsa, utrinque convexa, pallide castanea, arcte umbilicata ; anfr.* 5, *lineis longitudinalibus et volventibus minute rugosis, ultimo carinato, apertura rotundata, labro acuto.*

" Shell large, sinistral, orbicular, about equally convex above and below, but most rounded below ; of a pale chestnut or fawn-colour

above, growing paler to the umbilicus, where it is horn-colour. Surface somewhat undulated by the irregular lines of growth, and rendered minutely rugose by very fine, serpentine, revolving lines, forming conspicuous wrinkles near the carina; whorls 5, forming a regular, moderately elevated spire; the suture slightly impressed; the periphery surrounded by a prominent, compressed, but acute keel, which becomes lost towards the aperture; aperture rounded, height and width about equal; lip simple, slightly reverted in the umbilical region, some vitreous matter across the penultimate whorl; umbilicus rather large, but not deep.

"Diam. $1\frac{3}{4}$ inch, height 1 inch.

"This large heterostrophe *Helix* resembles an inverted specimen of one of that group of shells, so common and so varied, from the Philippine Islands, of which *H. lamarckii* is one. Young specimens might at first glance be confounded with *H. himalana*, Lea; but the *himalana* is much more globular, the surface less striated, the carina quite indistinct, and the umbilicus smaller.

"*Hab.* Province of Tavoy."

ARIOPHANTA? RETRORSA. (Plate XXXIV. fig. 4, a young specimen dissected.)

Locality. Mulé-it Range, Tenasserim (*O. Limborg*).

Shell sinistral, smaller and more solid than typical shells in Mr. Theobald's collection.

Sculpture (Plate XXXIV. fig. 5).

Size: maj. diam. 38·5, min. 32·0, alt. axis 18·0 mm.
,, 1·5, ,, 1·25, ,, 0·71 inch.

There are no shell-lobes to the mantle, and the dorsal lobes are quite simple. The odontophore has been noticed on p. 132 when describing the genus. The teeth (Plate XXXIV. figs. 8, 8 *a*) are arranged thus—

45 . 12 . 1 . 12 . 45
or
57 . 1 . 57.

ARIOPHANTA BAJADERA, Pfr.

Helix bajadera, Pfr. Zeitschr. f. Malak. 1850, p. 69; Chem. ed. ii. *Helix*, no. 860, t. cxxxiii. f. 10, 11; Pfr. Mon. Hel. vol. iii. p. 52, vol. iv. p. 250; Reeve, Conch. Icon. f. 388; Conch. Ind. p. 45 (as from Bengal, a wrong locality).

Ariophanta bajadera, Theob. Cat. Supp. p. 22 (Nagpur and Bombay); Nevill, Hand-list, p. 19.

Benson remarks, in the A. M. N. Hist. x. p. 350 (1852), that "Pfeiffer has ascribed his handsome reversed species, *Helix bajadera*, to Bengal, on the authority of Cuming's collection. I have always held this habitat as more than doubtful, no specimen having ever been detected in any quarter of the Bengal Presidency by myself or my fellow-labourers in this field;" and I find the following in MSS.:

"Lieut. H. Alexander, 10th Hussars, has since sent me *H. bajadera*, which he found in company with *Cyclostoma indicum*, Desh., between the Bhore Ghat and Bombay."

W. Blanford, in A. M. N. H. 1863, xi. p. 85, says, from an inspection of the type specimens of both shells, "I have ascertained that *N. ammonia*, Val., is founded on the type variety of *N. bajadera*, Pfr."

Original description:—"*T. umbilicata, sinistrorsa, globoso-conoidea, tenuiuscula, longitudinaliter valide plicata (plicis alternis minoribus), fulvida; spira conoidea, vertice obtusiusculo, rufulo; anfr.* 4, *convexiusculi, ultimus inflatus, medio subacute carinatus, antice descendens, basi juxta umbilicum angustissimum compressus; apertura obliqua, magna, lunato-rotundata; perist. simplex, rectum, margine columellari superne late dilatato-reflexo.*

"Diam. maj. 30, min. 25, alt. 20 mill. (*Mus. Cuming*).

"*Hab.* in Bengalia."

See under the next species the localities given by Mr. Blanford; I found it on the island of Elephanta, Bombay.

ARIOPHANTA INTUMESCENS, W. T. Blf.

Nanina (Ariophanta) intumescens, W. T. Blf. Cont. Ind. Mal. no. vi. J. A. S. B. 1866, p. 32.

Helix intumescens, Pfr. Mon. Hel. vol. v. p. 321; Conch. Indica, p. 45, pl. cxi. fig. 6 (a very good drawing).

Ariophanta intumescens, Theob. Cat. Supp. p. 23.

Nanina (Ariophanta) intumescens, Nev. Hand-list, p. 19.

Original description:—"Shell sinistrorse, narrowly and subobtectly umbilicated, globose, thin; finely, subplicately, transversely striated with obsolete decussating sculpture; dull fulvous-brown, horny, rather lighter in colour just above the periphery and around the umbilicus; spire conversely conoid, apex very obtuse, suture scarcely impressed; whorls $4\frac{1}{2}$, slightly convex, the last bluntly carinate, descending very little near the aperture, tumid beneath, compressed around the umbilicus; aperture large, diagonal, truncately subcircular; peristome white, subexpanded, margins approaching each other; columellar margin nearly vertical, rather broadly reflected, partly covering the umbilicus.

	millim.	inch.
"Major diameter	32	1·3
Minor ditto	26	1·05
Axis	22	0·9

"*Habitat.* Mahableshwur, Western Ghats of Hindustan.

"This fine species of *Ariophanta* has long been confounded with *Nanina bajadera*, Pfr., which is, however, although a variable shell, easily distinguished. *N. bajadera* is more globose and thicker, being at the same time more transparent; it has much stronger sculpture (and deeper sutures), and is always rounded at the periphery near the mouth, and frequently throughout, while in *N. intumescens* the

blunt angulation is persistent. *N. bajadera*, too, has a fine vitreous lustre, while *intumescens* is dull; and the former shell is usually of a greenish-olive colour, though varying in this character, and sometimes resembling the latter. The animals also show a difference in colour: that of *N. intumescens* is uniformly, so far as I have seen, dark cinereous, while that of *bajadera* is much lighter, but very variable. The latter shell is found mostly on shrubs, the former on the ground; and while *intumescens* has as yet only been found at Mahableshwur, 4500 feet above the sea, *bajadera* (which is rare at Mahableshwur) abounds on the equally or nearly equally high hills of Singhur and Poorundhur, and along the summit of the Western Ghats at about 2000 feet. It abounds at Khandalla at the top of the Bhore Ghat.

"I have already mentioned in a previous paper (Ann. Mag. Nat. Hist. for February 1863) that an examination of the type specimens of *N. bajadera*, Pfr., and *N. ammonia*, Valenciennes, has showed these two supposed species to be identical.

"I long doubted the distinctness of the species now described from *N. bajadera*; but although I have specimens of the latter from many different places, they are all easily distinguished from *N. intumescens*."

The teeth are similar to those of *A. interrupta*, var., but the median teeth have a decided small tooth on the inner margin, rendering them tricuspid; the laterals are long and narrow and gradually become very small on the outer margin, and are more numerous.

In a radula in Mr. W. T. Blanford's collection they are arranged thus:—

50 . 27 . 1 . 27 . 50
77 . 1 . 77

Ariophanta cysis, Bs.

Helix cysis, Bs. A. M. N. H. 1852, ix. p. 404; Pfr. Mon. Hel. vol. iii. p. 92, vol. iv. p. 194.

Helix cystis, Reeve, Conch. Icon. *Helix*, f. 737.

Helix cysis (var. *ampullarioides*), Hanley, Conch. Ind. p. 13, pl. xxv. fig. 5.

Helix ampullarioides, Reeve, Conch. Icon. *Helix*, f. 1423.

Helix auris, Pfr. P. Z. S. 1854, p. 286.

Ariophanta cysis, Theob. Supp. Cat. p. 213; Nev. Hand-list, p. 19.

Ariophanta cysis, Godw.-Aust. J. A. S. B. 1880, p. 152.

Mr. W. T. Blanford's collection contains a labial ribbon of this species, the arrangement of which is

60 . 22 . 1 . 22 . 60
or
82 . 1 . 82
(in 106 rows).

Original description :—" *Testa anguste et profunde umbilicata, sinistrorsa, depresso-globosa, tenuiuscula, oblique plicato-striata, fuscescente-cornea, spira convexa, apice planato; anfractibus 4, convexis, celeriter accrescentibus, ultimo inflato, primo obsolete angulato, tunc rotundato, antice breviter descendente, subtus tumido; apertura obliqua magna, subovato-lunata, peristomate simplici, acuto, marginibus conniventibus, externo et basali vix incrassatis, columellari breviter reflexiusculo.*

" Diam. major 43, minor 35, alt. 23 mill.

" *Hab.* in montibus ' Nilgherries,' Indiæ australis. Teste Jerdon.

" In form it is more globose and inflated than the other sinistral *Helices*, excepting *H.* (*Ariophanta*, Beck) *cicatricosa*, Müll. (China, Woosung), *quæsita*, Desh., and *bajadera*, Pfr. In figure it more nearly approaches *H. quæsita*, Desh. (Fér. t. 10 B. figs. 10, 12), but differs in the narrow umbilicus, smaller number of whorls, with a greater size, as well as in colour, texture, and less developed peristome."

Ariophanta thyreus, Bs.

Helix thyreus, Bs. Ann. M. N. H. vol. ix. p. 405 (1852); Pfr. Mon. Hel. vol. iii. p. 251, vol. iv. p. 301; Reeve, Conch. Icon. f. 735; Conch. Ind. p. 13, pl. xxvii. fig. 6 (good figure).

Ariophanta thyreus, Theob. Supp. Cat. p. 23; Nev. Hand-list, p. 19.

Ariophanta thyreus, Godw.-Aust. J. A. S. B. 1880, p. 152.

Locality. Sispara, Nilghiris, and Annamallays (*Beddome*).

Original description :—" *Testa profunde umbilicata, sinistrorsa depressa, orbiculata, supra cerea cornea, oblique radiatim plicato-striata, striis spiralibus exilissimis decussata, subtus convexa, polita, radiato-striata, fuscescente-cornea, infra carinam breviter saturatiore; spira convexiuscula, apice planato; anfractibus 4½, convexiusculis, lente accrescentibus, ultimo obtuse carinato, non descendente; apertura obliqua, lunata, intus livide purpurea, margine expansiusculo, reflexiusculo, columellari breviter recte descendente cum basali angulum efformante.*

" Diam. major 34, minor 29, alt. 16 mill.

" *Hab.* in India australi. Teste Jerdon.

" The umbilicus, although moderate, is peculiarly deep and distinct, comparatively with other orbiculate depressed shells of the group, showing, like *H.* (*Amœna*, Adams) *quæsita* (Desh., Molucca), all the whorls internally to the apex."

Ariophanta laidlayana, Bs. (Animal, Plate XXXIV. fig. 3, from No. 30 of Stoliczka's drawings.)

Helix laidlayana, Bs. A. M. N. H. xviii. p. 253 (1856); Pfr. Mon. Hel. vol. iv. p. 31.

Helix parietalis, Martens, Mal. Blätt. p. 167 (1864), *teste* Pfr.

Helix laidlayana, Conch. Ind. p. 27, pl. lviii. fig. 3, var. figs. 4 and 5 (fig. 4, from Cuttack, is the unbanded variety).

Ariophanta laidlayana, Theob. Cat. Supp. p. 23 ; Godwin-Austen, Journ. A. S. B. 1880, p. 155.

Nanina (*Ariophanta*) *laidlayana*, Nevill, Hand-list, p. 18.

Locality. Manbhum.

Original description:—" *Testa constricte perforata, sinistrorsa, turbinato-depressa, tenui, oblique striata, striis confertissimis spiralibus decussata, nitidiuscula, translucente, albida, fascia 1 supera angusta, rufo-castanea, periphæriam tangente, interdum 1 supera lata, et altera infera remotiuscula ornata ; periomphalo et pariete aperturali castaneis ; spira depresse conoidea, apice obtusiusculo, sutura leviter impressa ; anfractibus 5 sensim accrescentibus, ultimo ad periphæriam angulato, antice breviter descendente, subtus convexo ; apertura valde obliqua, subquadrato-lunata ; peristomate recto, acuto, margine columellari subrecte descendente, anguste reflexo, perforationem constrictam subtegente.*

" Diam. major 27, minor 23, axis 15 mill. ; apert 15 mill. lata, 13½ alta.

" *Hab.* in Provincia Bengalensi Bheerbhoom, ubi exemplum unicum junius detexit J. W. Laidlay ; nuperrime in Provincia Orissæ, non procul ab urbe Cuttack, exempla majora non raro invenit W. Theobald.

" Named after a former Secretary of the Asiatic Society of Calcutta, to whom I am indebted for a specimen found by him many years ago in the region of the late Santhal insurrection. The rediscovery of the shell in about 20° N. lat., as well as the detection of *H. capitium* in the same quarter, shows that these species range through nearly 5 degrees of latitude. The colouring of *H. laidlayana* has much resemblance to that of *H. quæsita*, Fér., but the shell has nearer relations to *H. interrupta*, nobis, and *H. trifasciata*, Müll. It differs from *H. interrupta* in colour, depressed form, greater number of whorls, contracted perforation, descent of the last whorl above the aperture, and in the disposition of the bands. When a single broad dark band is present in *interrupta*, it touches the angulate periphery. From *H. trifasciata* it differs in lustre, less depressed form, want of solidity, contracted perforation, more vertical columellar lip, and in the disposition of the bands, that which is above the periphery in *trifasciata* never touching the angle. The colour of the periomphalus and parietes of the aperture is also peculiar."

This species varies much : those with a broad brown band of colour on the upper surface of the whorls extending from near the periphery to the suture (Conch. Ind. fig. 5, plate lviii.) seem the most numerous ; some have the band very narrow (fig. 3), and in others it is absent, as in that given on Plate XXXIV., and fig. 4, Conch. Ind. plate lviii.

Ariophanta kadapaensis, Nevill, = *nicobarica*, Chemn.

Helix pomatia contraria nicobarica, Chem. ix. p. 79, tab. cviii. figs. 911, 912.

Helix nicobarica, Beck, Index Moll. Christ. Mus. Fred., Ap. p. 5 (1837), as a subgenus of *Nanina* (with no description); Pfr. Mon. Hel. vol. i. p. 40; Reeve, Conch. Icon. fig. 1157; Han. & Theob. Conch. Ind. p. 24, pl. lii. fig. 1 (back view only).

Ariophanta nicobarica, Theobald, Cat. Supp. p. 23.

Nanina (*Ariophanta*) *kadapaensis*, Nevill, Hand-list, p. 19 (renamed).

Ariophanta kadapaensis, Godw.-Aust. J. A. S. B. 1880, p. 152.

"*N. nicobarica*, Chem., is a misnomer, as it is not found at the Nicobars." The specimens in the Ind. Mus. Calcutta are from Golapilli and Jummulmulgoo, Kadapa dist., South India. Collected by Mr. W. King.

Description in Pfeiffer:—"*Testa perforata, sinistrorsa, solida, globulosa, oblique striata, castaneo-rufa, ad peripheriam, suturam et basin albo-zonata; spira brevis, obtusa; anfr.* $5\frac{1}{2}$, *convexiusculi, ultimus antice descendens, basi inflatus; apertura rotundato-lunaris, intus concolor; perist. simplex, obtusum, album, margine columellari reflexiusculo, perforationem fere tegente.*

"Diam. major 37, minor 30, alt. 27 mill. (*Mus. Gray*).

"*Hab.* in insulis Nicobarisis."

Genus Durgella.

Durgella, W. T. Blanford, A. M. N. Hist. ser. 3, 1863, vol. xi. p. 81.

Macrochlamys (*Durgella*) *honesta*, Stoliczka, J. A. S. B. 1871, p. 248.

Durgella, Godwin-Austen, Proc. Linn. Soc., Zool. vol. xv. 1881, p. 291.

The genus was founded by Mr. W. T. Blanford in February 1863 in his paper (*l. c.*) "On Indian Species of Land-Shells belonging to the Genera *Helix*, Linn., and *Nanina*, Gray," which was really the first attempt to classify the Indian land-shells by the form of the animal; and in the section *Nanina* the form of the mucous pore at the extremity of the foot was principally relied on, together with the character of the shell. It placed several species in their correct natural divisions which were before unknown; and the localities are authentic, which renders the paper a valuable one as regards their distribution. In *Durgella* he included three species:—

The type, *D. levicula*, Bs. Tenasserim (Theobald); Prome in Pegu.

D. mucosa, W. & H. Blf. Nilgiri Hills.

D. seposita, Bens. Darjiling.

I am very doubtful if *mucosa* can be placed in this genus: *seposita* may be, perhaps; but if, as Mr. G. Nevill thinks, *seposita* is the same as my *bilineata* from the Dafla Hills, then it must be removed; for the latter is a true *Macrochlamys*. The species *honesta*, as placed by Stoliczka in this genus, cannot be retained; he had not then ex-

amined the animal of *D. levicula*; it is also, I find, a true *Macrochlamys*. In my paper above mentioned I describe this shell from the typical locality (p. 293) in detail, together with another species, *D. assamica*, and two plates (xx. and xxi.) are given; these descriptions will be given in a subsequent part.

The Additional and Principal Characters of the Genus Durgella.

1. The right and left dorsal lobes moderate, the shell-lobes very ample; the right shell-lobe extends from the anal aperture (close to the upper angle of the shell-aperture) to the columellar margin, and spreads away over the shell in a broad triangular tongue; the left shell-lobe is reflected slightly over the edge of the shell in front, from near the respiratory orifice, and becomes wider on the lower margin as it approaches the umbilicus, and is also of triangular shape when extended. A large portion of the shell is always exposed.

2. The mucous pore is well developed, with a large overhanging lobe.

3. The jaw is very thin, membranaceous, almost straight on the cutting-edge, and with a very slight central projection.

4. The odontophore is broader than long, with a central minute generally bicuspid tooth; the lateral teeth all similar, minutely sexcuspid or pectiniform, on a curved edge; very closely set together and exceedingly numerous. +170 . 1 . 170+.

5. In the generative organs an amatorial organ is present in some species, absent in others.

6. Shell thin or membranaceous, globose or depressedly conoid; polished, very closely perforate, the columellar margin having no solidity.

The abnormality of this genus, as compared with shells of similar form, lies principally in the very remarkable odontophore, which is quite unlike any other Indian species of the Zonitidæ that I have examined; with this, of course, we find the jaw also much modified. There is considerable similarity with the teeth of *Sitala attegia* and *S. infula* (figured by Stoliczka in the J. A. S. B. 1871, pl. xviii. figs. 4–9) (*vide* Plate VIII. figs. 1 *e*, 2 *e*, Part II.) in the multicuspid or pectiniform laterals and the greater number (153 on each side) in *S. infula*; but the centre tooth is large, and the shell-lobes of the mantle are not developed; still here we have a relationship or connection indicated, and shown also in *Sitala phulongensis*, G.-A., Part II. p. 34 (Plate X. fig. 4), for since describing it I have succeeded in finding the lingual ribbon and jaw. There is a minute central, with a great number of similar lateral teeth, multicuspid, curved outwards, and set extremely close, gradually becoming smaller to the outside, and thus similar to those of *Durgella levicula*. This form of odontophore, which I have now observed in several species, a list of which I give further on, differs remarkably in type of the teeth and formula from other genera of the Zonitidæ; and I consider them a distinct group, having a remote relationship.

Sitala and *Durgella* are intimately connected by this characteristic dentition.

Durgella minuta, Godwin-Austen. (Plate XXXIX. figs. 1–6.)

Helicarion minutus, Godw.-Aust. J. A. S. B. 1876, p. 313, pl. viii. figs. 1, 1*a*, 1*b*.

Locality. Under Toruputu Peak, Dafla Hills (*H. H. G.-A.*).

Amended description. Shell depressedly ovate, horny, rather solid, with a glazed polished surface; colour brown, with an olive tinge, olive-green by transmitted light; spire rounded; suture deep; whorls 2½, very rapidly increasing; aperture oblique, laterally ovate; peristome thin; columellar margin not thickened, oblique.

Size: major diam. 6·7, minor diam. 4·8, alt. axis 2·7 mm.
,, 0·26, ,, 0·19, ,, 0·10 inch.

Animal (Plate XXXIX. figs. 2, 2*a*), dried specimen after soaking. Head black; foot well mottled with black, the pedal line is indicated by a double line of short oblong black streaks, with lateral spots above lying between the lateral grooves; the pedal margin pale. The central area of the foot beneath is for the entire length black, a very distinctive character in this species. The right shell-lobe (fig. 2) is ample, and the left (fig. 3) extends from the respiratory orifice, and is reflected over the shell; a tongue-like process on the left posterior margin, very narrow behind where it meets the right shell-lobe. The right dorsal lobe is of normal form and the left is narrow and continuous, saving a small slit on the left margin.

Odontophore. The radula (figs. 5, 5*a*) is very beautiful and characteristic of the genus, with one straight central tooth, succeeded by equilateral bicuspid teeth, all much curved inwards, and similar, very numerous, and very gradually decreasing in size to the outer margin of the lingual ribbon.

190 . 1 . 190

Jaw (fig. 4) slightly arched and no central projection.

It will be noticed at once how the radula of this species differs from that of *D. khasiaca* from the West Khasi Hills, alluded to on p. 313 of my paper "On the Helicidæ collected during the Expedition into the Dafla Hills, Assam," which I at first, in 1876, considered a variety of *D. minuta*, but on closer examination even the shell and animal are distinct in form and markings.

Living animal (Plate XXXIX. fig. 1). Pale horny; tentacles and a line from them to the mantle dark coloured, with a dark line down the upper surface of the extremity of the foot, which last is mottled on the side. The mantle just covers the edge of the shell, and the right shell-lobe is moderately developed. The portion of the body anterior to the shell is very short in comparison with the posterior portion. Total length 17·8 mm. = 0·7 inch; head to mantle 2·5 mm.; mantle to extremity of foot 10·7 mm. A well-marked hooked process above the mucous gland (fig. 1 *a*).

DURGELLA KHASIACA, n. sp. (Plate XXXIX. figs. 7, 7 *a*, 7 *b*.)

Locality. West Khasi Hills (*H. H. G.-A.*).

The shell has been drawn four times the natural size, to bring it to the size of *A. salia* (see on Plate XXXVII.), to better illustrate the slight difference in form of these shells.

Shell depressedly ovate, thin, horny, shiny, smooth, with close, fine, transverse lines of growth ; colour pale ochraceous olive ; spire very depressed, flatly convex ; suture shallow ; whorls 3, rapidly increasing ; aperture oblique, flatly ovate ; columellar margin but weakly developed.

Size : major diam. 6·7, minor diam. 5·0, alt. axis 2·0 mm.
„ 0·26, „ 0·20, „ 0·08 inch.

Odontophore. Jaw thin and horny, nearly straight in front. The radula (figs. 8, 8 *a*, 8 *b*) is a beautiful object in the microscope.

225 . 1 . 225

in 120 rows, or 54,000 teeth ; the central is elongate, with three equal-sized points ; the lateral teeth are all alike, much curved and bicuspid, the outer point slightly in excess of the inner, gradually decreasing in size outwards.

The right shell-lobe is triangular and extends over the right side of the shell ; the left is reflected over the peristome for some distance and then gives off a long lingual process. Extremity of foot very long and narrow.

We at present know

D. levicula, Bs.	Tenasserim.
D. assamica, G.-A.	Tezpur, Assam.
D. minuta, G.-A.	Dafla Hills.
D. khasiaca, G.-A.	West Khasi Hills.
D. christianæ, Theob.	Andaman Islands.
D. mairangensis, G.-A.	Khasi Hills.

This last will be described in a future part, with descriptions of the others.

SITALA (*continued from* p. 76).

The odontophore of *Sitala crenicincta* (described in Part II. p. 75, Plate XIII. fig. 2) is very similar in every way to that of *Kaliella barrakporensis* (Plate V. fig. 11), but the outer laterals are not tricuspid. The central tooth is very large (Plate XXXVIII. figs. 4, 4 *a*), tricuspid, the central point broad and long ; the median teeth are bicuspid, with the outer denticle near the base, while in the outermost three or four it nearly disappears. There are very few in the row, as follows :—

18 to 20 . 5 . 1 . 5 . 18 to 20
25 . 1 . 25.

KALIELLA (*continued from* p. 73).

I also figure a portion of the radula of *Kaliella kezamaensis* (Plate XL. fig. 10), which I described in Part III. p. 69, also a portion of the spermatophore (fig. 11). Among a large collection of shells from Darjiling in spirit I have been enabled to see the generative organs of *Kaliella barrakporensis* (Plate XXXVIII. fig. 5). There is no amatorial organ. The male organ is long and cylindrical, with a small pear-shaped kalc-sac situated at the junction of the vas deferens, the retractor muscle being given off some short distance below. The spermatheca was broken off.

Note. As the measurements given in this work differ somewhat from those adopted by some conchologists, on Plate XXXVIII. fig. 6 will be found a figure showing what I term the height of the axis, viz. the distance from the umbilical region at the base of the last whorl to the apex of the shell (A B). The height of the body-whorl is taken from the same point up to the plane of the suture of the last whorl in front, or B C. The height of the aperture is the perpendicular dropped from the upper angle of the aperture to the peristome below, or *a b*; the breadth of the aperture from the columellar margin to the outside edge of the peristome, *c d*.

Subfam. HELICARIONINÆ.

Genus HELICARION. (Plate XLI.)

Founded by Férussac on the Australian species *H. cuvieri*, Fér., or *freycineti*, Fér. I have therefore gone beyond the limits of my work, and give a Plate to illustrate this genus, which is so intimately connected with so many of our Indian forms. It will show more clearly what the extent of the differences are. I am sorry I could not obtain a larger species for this purpose, and I shall not at present give any general description of the genus.

In the generative organs there is the greatest departure, the shell-lobes being more like those of *Durgella*. These particular Australian, Indian, and African land mollusca thus form a good subfamily, under the title of HELICARIONINÆ.

HELICARION HELENÆ, n. sp. (Plate XLI. figs. 1–8 *a*.)

Locality. Sydney, N. S. Wales (*Dr. J. C. Cox*).

Shell elongately oval, polished, quite smooth; colour pale yellowish green; spire flat; whorls $2\frac{1}{2}$, the first small, rapidly increasing, the last much expanded and elongated in front; peristome thin, arcuate above.

Size: major diam. 7·3, minor diam. 4·5 mm.
,, 0·29, ,, 0·18 inch.

Animal (figs. 1, 1 *a*). Beautifully executed water-colour drawings from life by Mrs. H. Forde, dated the 3rd June, 1870, were sent

me by Dr. J. C. Cox, with the animal in spirit. The following note is attached by Mr. Geoffrey Nevill :—" *Helicarion hyalina*, Pfr., var. (Sydney). Coloration exact. When taken fresh from its damp home on the mossy sides of large stones &c., the mantle-lobes almost entirely cover the shell, leaving only a little bare spot. Top figure [Plate XLI. fig. 1] is as it appears after a day's confinement."

I am much indebted to Dr. Cox for sending this species and some others from Australia, and I am now able in consequence to show more clearly the anatomy of true *Helicarion* and the points of difference between it and the Indian allied forms; they are sufficient to keep them subgenerically apart.

Resembles exactly in its anatomy *H. freycineti*, Fér. (not Quoy and Gaimard), from N.S. Wales, figured in Semper's Reis. Philipp. pl. iii. fig. 1 (Plate XLI. fig. 9), even in the form of the flagelliform kalc-sac.

The mantle (figs. 2, 3) has a similarity to that of *Durgella*; the right shell-lobe is, however, the smallest, and is broadly tongue-like; the left shell-lobe includes the whole upper and outer margin of the peristome and terminates on the left posterior side in a tongue-like process; both right and left dorsal lobes are very ample, the left one especially, continuing all round to the posterior side and uniting with the right shell-lobe (fig. 4). The mucous gland is very distinct, with a small lobe or horn above it, but the foot above does not appear to be sharply keeled.

Generative organs (Plate XLI. figs. 8, 8 *a*). Ovo-testis in two rounded masses, very difficult to separate from the liver in which it is imbedded: hermaphrodite duct extremely and closely convoluted; albumen-gland small, hard, and oblong; penis long, twisted back on itself and swollen at the base, with a long flagellum, within which the capreolus was in process of formation; spermatheca long, with a swollen rounded extremity. It had no dart-sac or amatorial organ, and in this respect it differs from the Indian species that have hitherto been placed in this genus; the salivary gland rather lengthened.

Jaw (fig. 6) with a central projection, like *H. ceratodes*, Pfr.

In the lingual ribbon (figs. 7, 7 *a*, 7 *b*) the arrangement of the teeth is

$$\frac{40 \;.\; 2 \;.\; 16 \;.\; 1 \;.\; 16 \;.\; 2 \;.\; 40}{58 \;.\; 1 \;.\; 58}$$

The numbering of the last median teeth in fig. 7*a* is unfortunately reversed, 17 and 18 should be the two teeth of transition form next the bicuspid laterals. The outermost laterals are very small (fig. 7 *b*) and several are tricuspid in this specimen. I give a copy of the part of the radula of *H. cuvieri*, Fér., as given by Semper (*l. c.* pl. vi. fig. 11) to show the correspondence.

Subgenus Austenia, Nevill.

Helicarion, Fér., of many authors.

Vitrina, Fér., of many authors.

Austenia, Nev. Hand-list, p. 16 (Dec. 1878); Godwin-Austen, P. Z. S. 1880, p. 294.

This as a subgenus of *Helicarion* was indicated by Mr. Geoffrey Nevill in his valuable 'Hand-list of Mollusca in the Indian Museum,' Calcutta, part 1, issued in December 1878. It was not described, but the type was indicated, viz. *A. gigas*, a well-known form on the Khasi Hills. It is a sufficient departure structurally from *Girasia* of Gray to retain, this latter being more slug-like and with usually far less developed shells. In a paper in the 'Proceedings of the Zoological Society,' April 1880, p. 289, the animal of *A. gigas* was described by me in detail, as well as that of *Girasia shillongensis*, and the two compared, and the plates (xxiv.–xxvii.) contain figures of *Girasia magnifica*, *shillongensis*, *brunnea*, and *hookeri* (the type), and *Austenia gigas* and *gigas* var. *minor*. A list of the species as then known in both subgenera was also given and can now be somewhat added to and amended.

Characters of the subgenus. The animal is somewhat slug-like in appearance, but with a well-formed shell. The shell-lobes ample. The right dorsal lobe extends from the respiratory orifice to the posterior right margin. The left dorsal lobe is large in front and extends from the same part to the left margin. The shell-lobes are connected all round the periphery of the mantle-zone, but are reduced in size and present two distinct right and left contractile lobes; the right extends to and covers the apex of the shell, while the left extends over the edge of the body-whorl for a short distance, leaving the posterior and the greater portion of the upper surface of the shell uncovered (we have here, in a more developed form, what is seen in the genus *Macrochlamys*). The posterior margin of the shell is not sunk in a depression of the hinder part of the foot, but the upper surface of the foot extends in an unbroken ridge to the mantle-zone. Extremity of the foot truncate, with a large linear mucous gland, with or without an overhanging lobe; the pedal line very distinct. The sole of the foot with a central separate area.

Genital aperture at the lower outer base of the right tentacle.

The generative organs may be compared with those of *Macrochlamys indica* &c., and are, as might be expected, very similar; the amatorial organ is always present and well developed, and the spermatheca is large. The male organ, however, never has the coiled cæcum near the retractor muscle attachment so typical of all the species of *Macrochlamys*. The spermatophores are remarkably well formed and beautiful objects. The teeth of the radula and jaw as in *Macrochlamys indica*. The type and other species will be figured in future parts.

AUSTENIA PLANOSPIRA, Benson. (Plate XXXVI. figs. 1–5 *d*, Plate XXXVIII. figs. 1–1 *b*.)

Vitrina planospira, Benson, A. M. N. Hist. 1859, iii. p. 271; Pfr. Mon. Hel. vol. v. p. 14.

Vitrina succinea ?, Reeve, Conch. Icon. *Vitrina*, f. 8.

Helicarion (sec. C) *planospira*, Theob. Supp. Cat. p. 24.

Helicarion succineus, Reeve=*planospira*, Bs. Nev. Hand-list, p. 14.

Locality. Damsang Peak, Daling Hills (*W. Robert*).

Shell imperforate, very depressedly globose, rather swollen, thin, diaphanous, horny, polished; surface perfectly smooth; colour bright bronzy olive; spire rounded, scarcely raised above the last whorl; suture shallow; whorls 3, rapidly increasing; aperture oblique, broadly and horizontally ovate; peristome curving forward above, sinuate; columellar margin nearly perpendicular, but weakly developed.

Size: major diam. 13·5, minor diam. 10·3, alt. axis 4·5 mm.
„ 0·53, „ 0·40 „ 0·18 inch.

Original description:—"*Testa suborbiculato-depressa, peripheria rotundato-ovata, tenui, lævigata, obsolete arcuato-striatula, translucente, polita, cornea; spira convexiuscula, superne planata, sutura canaliculato-marginata; anfractibus* 3, *celeriter accrescentibus, ultimo antice depresso, leviter descendente, ad peripheriam compresse rotundato, subtus convexiusculo; apertura valde obliqua, ovato ?-lunari, peristomate tenui, superne antrorsum arcuato, margine columellari valde arcuato.*

"Diam. major 14, minor 11, axis 5 mill.

"Habitat ad Pankabari et in valle Rungun, *Vitrinæ salii* consors, raro occurrens.

"Only two dead and imperfect specimens were collected by Mr. W. T. Blanford. The species is remarkable for the sudden flatness of the upper part of the spire, and for the neat shallow canaliculate suture. It was found in company with a variety of the smaller and more convex *Vitrina salius*, B., which Mr. Theobald had previously taken alive on the Khasia Hills."

A specimen from Darjiling has been capitally drawn by Stoliczka's native artist, and I give a copy of it (Plate XXXVI. fig. 1). It represents the body as olive-brown in colour, and upon the coarsely papillate mantle and the size I make this identification. Mr. W. Robert's collection from Darjiling contains a number of well-preserved specimens, and I can now give a description of the animal (*vide* figs. 2 & 3). The right dorsal lobe is of the usual form, the left moderately broad, with a slight reentering contraction on the left frontal margin. The right shell-lobe is broad, with a strongly papillate surface, some of the projections being nipple-like, as observed in *A. verrucosa*, G.-A., from the Dafla Hills (J. A. S. B. 1876, p. 313, pl. viii. f. 5). The left shell-lobe is also papillate, and continuous all round to the right; it is broad in front, overlapping the peristome, but it narrows suddenly on the left middle margin.

The foot is truncate behind (fig. 4), with a slight overhanging lobe and a linear gland just reaching to the sole of the foot. This is divided below into a central area with a lateral margin.

The generative organs (Plate XXXVIII. fig. 1) are simple, the amatorial organ being large, showing, when the outer sheath is removed (fig. 1 *a*), a blunt cylindrical sagitta or dart with longitudinal muscular ribbing. The intestine (fig. 1 *b*) shows a large swollen sac near the œsophagus laid open by the salivary gland. The pulmonary chamber is very capacious.

The teeth of the radula are arranged thus :—

$$\frac{50 \,.\, 1 \,.\, 14 \,.\, 1 \,.\, 14 \,.\, 1 \,.\, 50}{65 \,.\, 1 \,.\, 65}$$

Similar to *Macrochlamys indica*, but the outermost laterals becoming gradually very small, the inner point the longest.

Austenia bensoni, Pfeiffer. (Plate XXXVI. figs. 6–7 *b*.)

Locality. Jessore (*G.-A.*).

Vitrina bensoni, Pfr. P. Z. S. 1848, p. 107 ; Pfr. Mon. Hel. vol. ii. p. 497 ; Reeve, Conch. Icon. *Vitrina*, fig. 9 ; Hanley, Conch. Ind. p. 29, pl. lxv. figs. 1–4.

Helicarion (sec. C) *bensoni*, Theob. Supp. Cat. p. 24.

Helicarion bensoni, Nev. Hand-list, p. 14, with this note :—" Mollusc granulated, especially the mantle, which is quite rough, being covered with small papillæ ; it entirely covers the shell ; jaw smooth, with slight projection in centre (*W. T. B.*). Botanical Gardens, Calcutta and Chandanagar."

Stoliczka has left a drawing (No. 2) with this title, and a note in his handwriting is as follows:—" Dull greenish grey, with a very slight pinkish tinge, or very pale olive with some dark irregular blotches; the larger marks on the mantle-lobes are whitish ; pedicels dusky ; sole of foot in three parts, middle narrowest, white, lateral parts dusky, speckled white." This drawing, which is very accurate, I reproduce (*vide* Plate XXXVI. fig. 6, nat. size) ; it shows the large expanded shell-lobes covering almost the whole shell save a small slit, and the animal conforms to the description of the genus in the ridge of the foot behind extending unbroken to the mantle-zone.

For radula see Plate XXXVIII. fig. 2. The formula is

$$\frac{45 \,.\, 3 \,.\, 12 \,.\, 1 \,.\, 12 \,.\, 3 \,.\, 45}{60 \,.\, 1 \,.\, 60}$$

It is like the general form of *Macrochlamys*, the laterals after the fifteenth being bicuspid, the inner cusp or point considerably exceeding the outer cusp in length ; the central and median are elongate, tricuspid in form.

Original description :—" V. *testa depressiuscula, tenui, striatula, nitida, pellucida, pallide cornea ; spira vix elevata, obtusa ; sutura impressa, submarginata ; anfractibus* 3½, *convexiusculis, ultimo sub-*

depresso, peripheria rotundata, basi lato ; apertura obliqua, lunato-subcirculari ; peristomate simplice, subinflexo, marginibus conniventibus, supero antrorsum subdilatato, columellari recedente, perarcuato.

"Diam. 12, altit. vix 6 mill.

"In the Botanic Garden of Calcutta ; collected by Mr. Benson."

AUSTENIA BENSONI, var. SYLHETENSIS. (Plate XXXVIII. fig. 3.)

Locality. In a wood on bank of the Soorma river, about halfway between Atgaon and Chatak, Sylhet District.

Shell depressedly ovate, thin, horny, shining, smooth surface; colour dull olive-green ; spire flattened, rounded ; suture shallow ; whorls 3, gradually increasing, the last tumid ; aperture oblique, broadly ovate ; peristome arcuate in front above ; columellar margin oblique.

Largest specimen :—

Size : major diam. 10·3, minor diam. 8·5, alt. axis 4 mm.
„ 0·41, „ 0·34, „ 0·16 inch.

This species differs from *bensoni* in the last whorl being more expanded in front, its thinner texture, and greener colour. The teeth of the radula are also modified in number, although of same type, as shown in Plate XXXVIII. figs. 2 and 3*c* ; the central teeth being exactly similar in both forms, are not repeated. Their arrangement is

64 . 2 . 14 . 1 . 14 . 2 . 64
80 . 1 . 80
(in 102 rows).

The outermost (fig. 3 *c*) are very small and show a tendency to be pectiniform, so characteristic of *Durgella*, and which in this case is evidently produced by the merging together at an early stage of development of two teeth into one.

The left shell-lobe (fig. 3 *b*) is narrow, giving off a broad linguate process on the left margin ; the left dorsal lobe is long and narrow, with a slight indentation opposite the above expansion. These differences taken together, in spite of the similarity of the shells, incline me to consider *A. sylhetensis* a distinct species.

Animal about an inch long ; tentacles black ; body light ; extremity of foot mottled with black and green. The animal carries this extremity turned up (as shown in Plate XXXVIII. fig. 3 *a*, which are copied from drawings made by me from life). On the under surface is an opening, from which exudes the mucous matter as the creature crawls ; it can be seen flowing down the underside of the foot in great quantity to the surface upon which it is moving. Shell in living animal dark, from the markings of the shell showing through it ; the oral tentacles short and light coloured, situated very near the mouth. Another animal from the same locality was thus described in my field note-book :—"Light yellowish green ; tentacles darker, the lower light ; a very few dark markings near the gland at extremity of foot." This, after all, is the same as the last species

described, for after examining it for some time it began creeping with the extremity raised in the same manner; so that it is the occasional habit of this species, which I at first thought was an individual peculiarity, due to the malformation of some muscles or injury to the nervous system.

AUSTENIA ? SALIA, Benson. (Plate XXXVII. figs. 1, 1 *a*, 1 *b*.)

Vitrina salius, Bs. A. M. N. Hist. 1859, iii. p. 189; Pfr. Mon. Hel. vol. iv. p. 799.

Helicarion salius (sec. C), Theob. Cat. Supp. p. 24.

Helicarion salius, Nevill, Hand-list, p. 14.

Austenia salia, Godwin-Austen, P. Z. S. 1880, p. 298.

Locality. Teria Ghat, Khasi Hills. (*H. H. G.-A.*).

Surface like ground glass, with indistinct, transverse, close lines of growth; colour pale ochraceous; whorls 3.

Specimen figured:—

Size: major diam. 9·8, minor diam. 8·4, alt. axis 3·5 mm.
„ 0·39, „ 0·33, „ 0·14 inch.

Largest specimen:—Size: major diam. 12·0, minor diam. 10·0 mm.

In no specimen that I possess from the typical locality does the last whorl descend near the aperture, as in specimens from Pankabari, near Darjiling.

Original description:—"*Testa subgloboso-depressa, peripheria ovata, tenuissima, fragili, nitidissima, pellucida, fuscescenti-cornea vel pallide cornea, obsolete arcuatim striatula; spira brevissime conoidea, sutura leviter impressa, marginata; anfractibus 3½, rapide accrescentibus, ultimo depressiusculo, subventricoso-rotundato, antice superne antrorsum arcuato; apertura obliqua, subrotundato-lunari, peristomatis margine columellari subverticaliter descendente, superne vix calloso, basali leviter arcuato.*

"Diam. major 8, minor 6, axis 4 mill.; apert. lat. 4½, alt. 4½ mill.

"Habitat ad Teria Ghát, cum præcedente.

"I have named this little species from its habit, observed by Mr. Theobald, of springing several inches from the ground, like the little Cape *Helix Tollini*, Albers, recorded in a former number of this Journal on the authority of Mr. E. L. Layard. *V. salius* also occurs near Darjiling, where Mr. W. T. Blanford has found it sparingly, in company with another new species.

"Mr. Theobald met with my large species, *Vitrina gigas*, at Cherra, on the mountains above Teria Ghát; it was not common. On the limestone at the same place, a solid variety of the Western-Himalayan shell, *H. plicidens*, B., was common."

AUSTENIA ? SALIA, Bs., var. OVATA. (Plate XXXVII. figs. 2, 2 *a*, 2 *b*.)

Locality. Pankabari, near Darjiling (coll. W. T. Blanford).

Shell rather more globose in form than the Teria-Ghat shells, the

last whorl descending and rather more expanded in front (compare figs. 1 *b* and 2 *b*).

Size: major diam. 9·8, minor diam. 7·8, alt. axis 4 mm.
„ 0·39, „ 0·31, „ 0·16 inch.

Austenia ? panchetensis, n. sp. (Plate XXXVII. figs. 3, 3 *a*, 3 *b*.)

Locality. Panchet Hill, near Ranigunj, L. Bengal (ex coll. W. Blanford).

Shell imperforate, depressedly globose, rather thickened, covered with a strong epidermis; colour dull ochraceous brown; spire depressed, rounded; suture shallow; whorls 3, flat above, and rapidly increasing, the last descending; aperture very oblique, ovate; peristome rather thickened, columellar margin perpendicular.

Size: major diam. 10·7, minor diam. 9·0, alt. axis 4·5 mm.

This shell is very distinct from *A. bensoni* in the manner in which the last whorl descends near the aperture and in its more shelly structure and globose form. There is only one specimen in Mr. W. Blanford's collection. It is very probably the No. 16, *Helicarion ovatus*, Nev. Hand-list, p. 14, 8 specimens Rajmahal, Sikrigulli, and Patna (coll. Col. G. Mainwaring and Dr. Oldham).

Austenia papillaspira, n. sp. (Plate XXXVII. figs. 4, 4 *a*, 4 *b*.)

Locality. North Khasi Hills.

Shell imperforate, globose, membranaceous, shining; sculpture, transverse undulations of growth, otherwise quite smooth; colour pale ochraceous green; spire somewhat raised, small, apex like a small nipple; suture shallow; whorls 4, irregularly wound, closely so at apex, the third covering the second on the anterior margin, the axis not being straight; aperture oblique, widely ovate; peristome sinuate on upper margin, curving forward; columellar margin perpendicular, a slight reflection at umbilical region.

Size: major diam. 11·0, minor diam. 8·8, alt. axis 4·5 mm.

Differs from *A. salia* in the greater number of whorls and peculiar, smaller, closer-wound, nipple-like apex. Three specimens were found.

Austenia ? globosa, Godwin-Austen. (Plate XXXVII. figs. 5, 5 *a*, 5 *b*.)

Helix (*Nanina*) *globosa*, Godw.-Aust. J. A. S. B. 1876, p. 312.

Helicarion No. 17, n. sp. (prox. *H. bensoni*), Nev. Hand-list, p. 51, 5 sp. from Dikrang and Toruputu Peak (*G.-A.*)

Locality. Toruputu Peak, Dafla Hills (*H. H. G.-A.*).

Shell imperforate, tumidly globose, very thin, transparent, glassy, quite smooth; colour pale ochraceous; spire moderately high, depressedly conoid; whorls 3, last well rounded, rapidly increasing; aperture oblique, rotundately oval; columellar margin weak, not thickened.

Specimen figured :—

Size: major diam. 9·4, minor diam. 7·5, alt. axis 3·4 mm.

„ 0·37, „ 0·30, „ 0·14 inch.

Largest specimen :—

Size: major diam. 9·5, minor diam. 8·0, alt. axis 4·8 mm.

Original description :—"Shell very globose, thin, and glassy, pale ochre; whorls 4, the last large and expanded below. Aperture broadly lunate. Apex rounded.

"Alt. 0″·28, major diam. 0″·40.

"Animal dark grey, becoming pale fleshy on extremity of foot, which is broad behind, with the lobe over the gland much hooked. Tentacles rather thick at base. Length 1″·2, tentacles 0″·2.

"*Hab.* Summit of Toruputu Peak.

"This shell is of the form of *H. salius*, but is much larger; and the animal differs considerably."

Subgenus Africarion, Godw.-Aust.

Africarion pallens?, Morelet. (Plate XLII. figs. 1–7.)

Locality. Abyssinia (from Mr. Damon, as *Vitrina rüppelliana*, Pfr.).

Helicarion pallens, Morelet, Annali del Museo Civico di Storia Naturale di Genova, p. 190 (1872).

Shell ovoid, depressed; surface smooth; spire very slightly elevated near the apex, which is rounded; whorls 3, closely wound, the last expanding much; the line of suture is not a regular spiral, from the last whorl closing in on the second and narrowing its breadth in front very considerably.

Size: major diam. 13, minor diam. 9·4 mm.

Animal (Plate XLII. figs. 1, 2, 3), in spirit-specimen, 22·5 mm. in length, with a truncate glandular extremity of foot; the pedal line distinct, with some black spottings, the pedal margin having a few at the posterior end; the dorsal portion above is also darkly mottled. The mantle-lobes are finely and distinctly papillate and closely mottled with black. The right shell-lobe is broad, extending towards the shell; it narrows posteriorly, and is continuous round to the left shell-lobe. The right dorsal lobe is small, but the left very ample and continuous. The ridge of the foot behind, just beneath the posterior margin of the shell, forks into two ridges (fig. 3), and this portion of the shell rests in the long triangular depression between them, a formation of the body similar to that of *Girasia*.

Odontophore (figs. 6, 6 *a*, 6 *b*). As in *Macrochlamys*; the laterals bicuspid, the inner cusp much longer than the outer, which is small and on the last scarcely developed. The teeth are arranged

28 . 2 . 12 . 1 . 12 . 2 . 28
42 . 1 . 42

The jaw (fig. 7) is much arched, with a concave cutting-edge and a central projection.

The buccal mass has a strong retractor muscle (Plate XLII. fig. 5). There is a short narrow œsophagus passing into a very capacious bag-like stomach, on the side of which the salivary gland lies.

The generative organs (fig. 4) are very simple; there is no amatorial organ. The spermatheca is short, with a round-shaped sac at the posterior end. The male organ is a simple, long, cylindrical tube with a strong, short, retractor muscle, and thus similar to that of the genus *Arion*, and so very different to the more complicated form of *Girasia* and allies, and also to the Australian form of true *Helicarion* (*vide* Plate XLI.). The albumen-gland is very large.

Although the combined characters of this specimen would place it in the subfamily Helicarioninæ, it differs sufficiently from the Indian genera *Girasia* and *Austenia*, and also from the Australian genus *Helicarion*, to be placed in a separate subgenus. For these East-African forms I would propose the subgeneric title *Africarion*.

There is considerable doubt regarding the identification of Damon's specimen. Blanford, in his work 'Geology and Zoology of Abyssinia,' records three species of *Vitrina* (p. 475), and among them *V. rüppelliana* *, apparently only one (unnamed) he captured alive at Lake Ashangi, and he notices that it is a true *Vitrina* with no mucous pore. In Nevill's Hand-list, p. 18, under *V. mamillata*, Martens, from above locality, is a detailed description by Blanford of this species, which I will copy:—

"Animal apparently not retractile; mantle large and rugose, only partially reflected over peristome, a little more so over the shell at the suture; foot coarsely granulate above, sole not margined by a furrow at the side; tail bluntly keeled above, pointed, with no trace of a gland; three furrows from near breathing-orifice to lower tentacles, lower two uniting in front; lower tentacles short, upper one (eye-pedicels) moderate; the rounded process of the mantle, reversed over the suture, sometimes reaches the apex, and appears easily extensible. Pale flesh-colour, yellowish on back, two dark lines from base of tentacles: mantle with opaque yellow spots; jaw narrow, without process in centre, smooth."

Mons. Bourguignat has lately published (1883) a work, 'Histoire Malacologique de l'Abyssinie.' In this a small species (*raffrayi*) is described and placed in *Helicarion*; it is figured with a mucous pore on pl. vii. fig. 13. *H. lymphaseus*, Morelet, and *H. pallens*, Morelet, are also referred to as occurring in the Bogos country: *rüppelliana* is placed in *Vitrina*, and on pl. vii. fig. 10 the very pointed form of the extremity of the foot is given. The species received from Mr. Damon is about the size and form as *rüppelliana*; the identification must be wrong, but at any rate the African habitat would appear to be correctly given by him.

On referring to Mr. Damon for the history of this species, he says:—"I have only had Abyssinian shells from Issel and a dealer named

* *Vitrina rüppelliana*, Pfr. P. Z. S. 1848, p. 107; Pfr. Mon. Hel. vol. ii p. 503 (very like *præstans*, Gd.); = *V. darnaudi*, Pfr. W. Blanford, Zool. Abyss. p. 475; J. R. Bourguignat, Malac. Abyss. p. 20, pl. 7. fig. 10 (animal).

Wesel of Hamburg. The *Vitrina* in question must therefore have been from the latter.....I see that the specimen in question came to me in 1870." Monsieur A. Issel has very kindly given me the information that, during his trip into the Bogos country, he only obtained *V. caillaudi* and *Isseli*, and *Helicariom lymphaseus* and *pallens*, but not *V. rüppelliana* ; therefore Mr. Damon could not have received it from him. He continues, the two species of *Helicarion* were preserved by me in spirit, but that on looking for them in the Museo Civico di Storia Naturale, Genova, only the shells remain, the animals having probably decayed and the shells removed from the tubes.

The animals of these two species of *Helicarion* are thus described by Morelet (*l. c.*) :—

Helicarion lymphaseus, Morelet, t. ix. f. 4.

"L'animal est épais, finement grenu, d'un fauve livide, couleur de fer sur le dos; le pied, nettement tronqué, est percé d'un pore assez large que l'on voit à l'œil nu. Le plan locomoteur est separé du corps par un sillon.

"*Testa depressa, tenuissima, nitida, hyalina, pallide fulva, inæqualiter arcuato-striata ; spira planulata, vertice obtusa, vix prominula ; sutura strictissime marginata ; anfr.* 3, *superne plani, subtus convexi, ultimus celeriter crescens, subelongatus ; apertura obliqua, oblonge ovalis, basi rotundata, marginibus rectis, parallelis.*

"Diam. maj. 13, min. 9, altit. 6 millim."

Helicarion pallens, t. ix. f. 5.

"L'animal ressemble tout à fait au précédent; le lobe postérieur du manteau est marqué d'un ligne couleur de fer dans le sens longitudinal.

"*T. superne depressa, subtus turgidula, tenuis, striolata, nitida, pellucida, pallide straminea ; spira brevis, obtuse rotundata ; anfr.* 3, *convexiusculi, ultimus amplus, juxta suturam marginatam radiatim obsolete plicatus ; apertura perobliqua, lunato-ovalis, margine columellari arcuato nec membranaceo.*

"Diam. maj. 12–13, min. 8, altit. 5 millim."

Both found in the Bogos country by Messrs. Issel and Beccari. From the dark line on the left shell-lobe of Mr. Damon's specimen (Plate XLII. fig. 2) I believe it to be this last species.

While these sheets are passing through the press, I have just received two more specimens from Mr. Damon. As regards the animal, they agree with *H. pallens*, but in the size and form of the shell better with *H. lymphaseus*. Monsieur Issel will, I hope, do me the favour of settling the true identification, after a comparison of these specimens with the types at Genoa. It may possibly be a new species. In both specimens the whorls are irregularly wound, the last contracting and covering over the second.

The examination of many different species of *Macrochlamys* and those of allied genera begins to afford sufficient material on which to base their classification; and I am now convinced and hope to show that a system commencing with *Helicarion*, as if that were a primordial form, cannot be adopted. I think I have given sufficient examples of the modification of the shell-lobes of the mantle in these genera and subgenera to show clearly that their gradual growth has been in the direction from genera without such appendages to those that possess them. Climate has, no doubt, had a great influence in producing this change, certainly facilitating the growth of it. The highly-heated damp atmosphere of the Khasi Hills, particularly the southern side, where for hours the air is in a state of complete saturation, tends to the enlargement of such appendages, until we reach forms like *Austenia bensoni*, *planospira*, &c., and with still greater extension and spread of the same part of the mantle in species like *Girasia hookeri* &c., where the junction of the two originally disconnected lobes is so admirably shown by the distinct cicatrice along the line of junction (P. Z. S. 1880, pl. xxiv. figs. 1, 2, and pl. xxvii. fig. 1), indicating that even in the young the lobes are not quite united, but do so as development proceeds, an interesting case of the tendency of homologous parts to cohere, one of the many interesting facts put forward by Darwin. The interesting result is yet to be noted, that as the animal thus gains an extra protection to the most vital organs of the body within the spire of the shell, this latter structure becomes less and less developed until we find only a mere thin horny or membranaceous shell; for instance, in forms such as *Girasia burtii*, where the shell-lobes unite completely, the apex of the spire is reduced to a mere nucleus, of rounded form, at the end of a narrow strip of thin membrane, which readily breaks off from it. This cannot be considered a retrogression or deterioration in development; from a pure conchological point of view it may be, but in fact it is a great stride in advance.

This slug-like form which, having got rid of a structure superfluous to its existence and a great tax on its powers to construct, remains as perfectly developed in all its organs as the most highly specialized mollusks with solid shells, and is able to hold its own against its numerous enemies; in fact, its form is greatly in favour of its prolonged existence, seeing that it is better able to conceal itself deeper among the crevices of the rocks, under stones, and in the cracks of fallen trees, or underneath the bark, situations inaccessible to most of the shell-bearing species, certainly to all those of equal size. I do not think it is possible to find a better instance of gradual development of species, *i. e.* with so many existing links presented to us by these interesting forms of the Zonitidæ. It is not difficult to imagine a similar kind of evolution from some helicoid ancestor developing a form like our common *Arion* or *Limax*. Development has in this case proceeded further, for in these two genera the body-cavity extends to the extremity of the foot, and is occupied by the coils of the intestine, the liver-lobes, &c. Now

even in some species of *Girasia* we see a tendency to a similar development, viz. a diminution in the size of the muscular foot and the body-cavity extending considerably further back into it in a posterior direction and occupied by a great fold of the intestine and a mucous gland. The evidence of gradual development shows that *Girasia* must be placed towards the end of the series of genera of Indian Zonitidæ. Many more genera must yet be examined before this classification can be completed.

EXPLANATION OF PLATE XXII.

All enlarged 2·4.

Fig. 1. *Macrochlamys petrosa*, Hutton.	Rajmahal.
2, 2 *a*. —— *prona*, Nevill.	Mussoorie, N.W. Himalaya.
3. —— *exul*, Theobald.	Andaman Islands.
4, 4 *a*. —— *splendens*, Hutton.	Mussoorie.
5. —— *shengorensis*, G.-A.	Dafla Hills.
6, 6 *a*. —— *choinix*, Benson.	Andamans.

EXPLANATION OF PLATE XXIII.

All enlarged 2·4.

Fig. 1. *Macrochlamys hardwickei*, G.-A.	Calcutta.
2. Ditto.	Sylhet.
3. Ditto, var. *politulus*.	Eastern Assam.
4. Ditto, var.	Darrang.
5. *Macrochlamys lhotaensis*, G.-A.	Lhota-Naga Hills.
6, 6 *a*. —— *opiparus*, G.-A.	Darjiling.

EXPLANATION OF PLATE XXIV.

All enlarged 2·4.

Fig. 1. *Macrochlamys atricolor*, G.-A.	North Cachar Hills.
2. Ditto, large var.	Munipur Hills.
3. Ditto, small var.	Munipur Hills and Burrail range.
4. Ditto, var.	Dafla Hills.
5. Ditto, var.	Khakyen Hills, Upper Burmah.
6. *M. cacharica*, G.-A., var. *glauca*.	Dafla Hills.
7. *M. lubrica*, Bs.	Darjiling.

EXPLANATION OF PLATE XXV.

Macrochlamys atricolor, G.-A. Munipur Hills.

Fig. 1. Animal, spirit-specimen, showing mantle and shell-lobes, × 2·4.
2. Ditto, viewed from right side, showing position as regards the shell, × 1·5.
3. Ditto, mantle, viewed from left side, × 2·4.
4. Entire animal, left side, × 2·4.
5. Head, viewed from right side, showing position of generative aperture, × 2·4.
6. Head, front view, showing form of mouth, × 4.
7. Extremity of foot, viewed from behind, × 7.
8. Mantle, viewed from below or inside, showing the division into two lobes.
9. Same view of mantle in *M. indica*, Bs. Calcutta.
10. Mantle of *M. indica*, viewed from the outside, showing the additional shell-lobe.

EXPLANATION OF PLATE XXVI.

All enlarged 2·4.

Fig. 1. *Macrochlamys? resplendens*, Phil. Tenasserim.
2. Ditto. Cambodia.
3. Ditto. Siam.
4. —— ? *consepta*, small var. Tenasserim.
5, 5 *a*. *Macrochlamys koliaensis*. Assam.
6. —— *politissima*, Pfr. Ceylon.
7. —— *jainiana*, n. sp., G.-A. Parisnath.
8. —— *jainiana*, n. sp., =*stricklandi*, MS., G.-A. Jeypur.

EXPLANATION OF PLATE XXVII.

(*Vide* shell of Plate XXIV. fig. 2.)

Fig. 1 *a*. *Macrochlamys atricolor*, G.-A., jaw, × 12. Munipur Hills.
1 *b*. Ditto: teeth of radula, × 360.
1 *c*. Ditto: salivary gland: *a*, intestine; *c*, duct of gland.
1 *d*. Ditto: generative organs, × 2·4.
2. *Macrochlamys cacharica*, n. sp., × 2·4. Munipur Hills.
2 *a*. Ditto: jaw, × 12.
2 *b*. Ditto: radula, × 360.
2 *c*. Ditto: generative organs, × 4.
3. *Macrochlamys atricolor*, small var. Kopamedza Peak, Naga Hills.

EXPLANATION OF PLATE XXVIII.

Fig. 1. *Macrochlamys hardwickei*, n. sp., portion of radula. Calcutta.
1 *a*. Ditto: generative organs, enlarged.
1 *b*. Ditto: male organs, much enlarged.
2. *Macrochlamys jainiana*, n. sp. Parisnath. Portion of radula, median and lateral teeth, × 360.
2 *a*. Ditto: jaw, × 12.
2 *b*. Ditto: portions of the spermatophore, × 50.
2 *c*. Ditto: ditto, × 180.
2 *d*. Ditto: ditto, × 180.
2 *e*. Ditto: spermatophore, posterior end of, × 180.
3. *Macrochlamys koliaensis*, n. sp. (*vide* Plate XXVI. figs. 5, 5 *a*): portion of radula, × 360.

EXPLANATION OF PLATE XXIX.

Fig. 1, 1 *a*. *Macrochlamys castaneo-labiata*, G.-A., × 2·4. Munipur Hills.
2. Ditto, × 2·4. Asalu.
3. Ditto, × 2·4. Rezameh, Naga Hills.
4. Ditto: mantle and lobes of No. 1, × 4.
5. Ditto: jaw, × 12.
6. Ditto: central portion of radula, × 180.
6 *a*. Ditto: an Asalu sp., × 340.
6 *b*. Ditto: median teeth 6 to 10, × 340.
6 *c*. Ditto: outermost laterals, × 340.
7. Ditto: generative organs of No. 1, × 4.

EXPLANATION OF PLATE XXX.

Fig. 1, 1 *a*. *Oxytes oxytes*, Bs. Shell, natural size; largest specimen from S.W. Khasi Hills.
2, 2 *a*. Ditto: usual size. Same locality.
3. Ditto: animal. Cachar. From original drawing (No. 36) by native artist in Library, Indian Museum, Calcutta.
3 *a*. Ditto: the mucous gland, viewed from above.
3 *b*. Ditto: tentacles.
4. *Oxytes orobia*, Bs., from Stoliczka's original drawing (No. 45), made by a native artist.

EXPLANATION OF PLATE XXXI.

Fig. 1. *Oxytes cycloplax*, Bs., nat. size, juv. W. Bhutan Hills.
2. Ditto: animal, shell removed, viewed from right side, × 4.
3. Ditto: extremity of foot, viewed from behind, × 4.
4. Ditto: mantle-edge, as seen from left side, × 4.
5. Ditto: jaw, × 12.
6. Ditto: radula, centre teeth of, × 180.
6 *a*. Ditto: last median and first lateral teeth, × 180.
6 *b*. Ditto: outermost laterals, × 180.
7. Ditto: generative organs, × 4.
8, 8 *a*, 8 *b*. *Oxytes cycloplax*, Bs., adult shell, nat. size. Darjiling.

EXPLANATION OF PLATE XXXII.

Fig. 1. *Oxytes orobia*, Bs. Darjiling. Animal, from spirit-specimen, left side, with shell nearly all removed.
1 *a*. Ditto: right side and sole of foot.
1 *b*. Ditto: the left postdorsal lobe, enlarged.
2. Ditto: jaw.
3. Radula, central portion, × 200; 3 *a*. Ditto, newer teeth; 3 *b*. 9th, 10th and 11th median; 3 *c*. 15th to 20th lateral teeth; 3 *d*. The outermost laterals.
4. Portion of animal in apex of shell, showing position of the hermaphrodite duct and liver-lobes.
5. Generative organs.
5 *a*. Junction of hermaphrodite duct with the albumen-gland, very much enlarged.
5 *b*. Portion of male organ, showing the kalc-sac and coiled cæcum of the retractor muscle.

EXPLANATION OF PLATE XXXIII.

Fig. 1. *Ariophanta immerita*, W. Blf., nat. size. South India.
2. Ditto: mantle viewed from left side, shell removed, × 4.
2 *a*. Ditto: the same turned back.
3. Ditto: side view of extremity of foot.
3 *a*. Ditto: back view of same, showing mucous gland.
4. Ditto: jaw, × 7.
5. Ditto: teeth of radula, central portion, × 340.
5 *a*. Ditto: 20th to 24th median, 25th and 26th intermediate.
5 *b*. Ditto: outermost laterals.
6. Ditto: generative organs, × 2·4.
6 *a*. Ditto: male organ, × 4.
7, 7 *a*. *Ariophanta lævipes*, Müll., nat. size. Bombay.

EXPLANATION OF PLATE XXXIV.

Fig. 1. *Ariophanta lævipes*, Müller.
1 *a*. Ditto: extremity of foot from above.
2, 2 *a*. *Ariophanta interrupta*.
3. —— *laidlayana*, Pfr.

The above are copied from drawings by a native artist.

4. *Ariophanta ? retrorsa*, Gould, nat. size. Tenasserim.
5. Ditto: sculpture of last whorl, × 12.
6. *Ariophanta interrupta*: sculpture of last whorl, × 12.
7. —— *retrorsa*: jaw.
8. Ditto: central and three median teeth of radula.
8 *a*. Ditto: 8th, 9th, and 10th median, 11th transition, and first laterals.

EXPLANATION OF PLATE XXXV.

Fig. 1, 1 *a*. *Macrochlamys dalingensis*, G.-A., × 2·4. W. Bhutan Hills.
2. Ditto: sculpture on last whorl, × 50.
3. Ditto: animal, right side, showing mantle and shell-lobes, × 4.
4. Ditto: ditto, left side, ditto, × 4.
5. Ditto: ditto, front view, × 4.
6. Ditto: extremity of foot, showing mucous gland, × 7.
7. Ditto: jaw, × 12.
8. Ditto: odontophore, central teeth, × 200.
8 *a*. Ditto: ditto, × 200.
8 *b*. Ditto: ditto, last laterals, × 200.
9. Generative organs, × 2·4.
10. Buccal mass, mucous and salivary gland, × 2·4.

EXPLANATION OF PLATE XXXVI.

Fig. 1. *Austenia planospira*, Bs. Darjiling. From a drawing by a native artist.
2. Ditto: from a spirit-specimen, right side, × 2·4. Western Bhutan Duars.
3. Ditto: ditto, left side, × 2·4. Ditto.
4. Ditto: the mucous gland, viewed from behind, × 7. Ditto.
5. Ditto: shell, nat. size. Ditto.
5 *a*, 5 *b*, 5 *c*, 5 *d*. Ditto: shell, × 2·4. Ditto.
6. *Austenia bensoni*, Pfr., nat. size. Calcutta. From a drawing by a native artist.
7, 7 *a*, 7 *b*. Ditto: shell, × 2·4. Jessore District.

EXPLANATION OF PLATE XXXVII.

Fig. 1, 1 *a*, 1 *b*.	*Austenia salia*, Bs., × 2·4.	Teria Ghat.
2, 2 *a*, 2 *b*.	—— *salia*, Bs., var. *ovata*, × 2·4.	Darjiling.
3, 3 *a*, 3 *b*.	—— *panchetensis*, × 2·4.	Lower Bengal.
4, 4 *a*, 4 *b*.	—— *papillaspira*, G.-A., × 2·4.	N.W. Khasi.
5, 5 *a*, 5 *b*.	—— *globosa*, × 2·4.	Dafla.

EXPLANATION OF PLATE XXXVIII.

Austenia planospira, Benson. W. Bhutan Hills.

Fig. 1. Generative organs, × 4.
1 *a*. Amatorial organ, × 7.
1 *b*. Buccal mass and gland, salivary gland, &c., × 4.

Austenia bensoni, Pfr. Calcutta.

2. Radula, median and laterals, × 340.

Austenia bensoni, var. *sylhetensis*. Sylhet.

3. Shell, × 2·4.
3 *a*. Extremity of foot and mode of carrying it (enlarged).
3 *b*. Mantle-edge removed, × 4.
3 *c*. Radula, × 340.
4, 4 *a*. *Sitala crenicincta* (Plate XIII. figs. 2, 3): radula, × 1250.
5. *Kaliella barrakporensis*: generative organs, × 12.
6. To illustrate the dimensions as given in this work.

EXPLANATION OF PLATE XXXIX.

Fig. 1. *Durgella minuta*, G.-A.: from life, nat. size. Dafla Hills.
2. Ditto: view of right side, showing the shell-lobes, × 4.
2 *a*. Ditto: left side, ditto, × 4.
3. Ditto: shell, × 4.
3 *a*. Ditto: ditto, × 2·4.
4. Ditto: jaw, × 20.
5. Ditto: central tooth of radula and adjacent teeth, × about 1250.
5 *a*. Ditto: laterals near margin.
6. Generative organs, × 7.
7, 7 *a*. *Durgella khasiana*, G.-A., from life, nat. size. West Khasi Hills.
7 *b*. Ditto, × 2·4.
8. Ditto: central teeth of radula, very much enlarged.
8 *a*. Ditto: ditto, two rows, × 340.
8 *b*. Ditto: the outermost laterals, very much enlarged.

EXPLANATION OF PLATE XL.

Fig. 1. *Macrochlamys kala*, G.-A.: shell, × 4. Western Bhutan Hills.
1 *a*. Ditto: ditto, × 2·4.
1 *b*. Ditto: ditto, nat. size.
2. Ditto: animal, viewed from right side, shell removed, showing shell and dorsal lobes, × 4.
3. Ditto: ditto, viewed from left side, × 4.
4. Ditto: shell and dorsal lobes removed, × 7.
5. Ditto: Generative organs, × 4.
6. Ditto: male organ: *sp*, the spermatophore developing, × 7.
7. Ditto: spermatheca, × 12: *sp*, a spermatophore within it.
8. Ditto: jaw, × 12.
9, 9 *a*. Teeth of radula, × 340.
10, 10 *a*. *Macrochlamys kezamaensis*, G.-A. (Plate XV. figs. 3, 3 *a*): portion of the radula, × 1250.
11. Ditto: a portion of spermatophore, × 110.

EXPLANATION OF PLATE XLI.

Fig. 1, 1 *a*. *Helicarion helenæ*, n. sp. Sydney. From a drawing by Mrs. H. Forde.
2. View of right side of a spirit-specimen, shell removed, showing mantle and lobes, × 4.
3. View of left side, ditto.
4. View from behind.
5. Shell, × 4.
6. Jaw, × 12.
7, 7 *a*, 7 *b*. Portions of a row of the radula, × 340.
8. Generative organs, × 4.
8 *a*. Male organ, × 12.
9. *Helicarion cuvieri*: generative organs, after Professor Semper.
10. Ditto: teeth of radula, central, Nos. 1, 5, 14, 17, and 20, × 260.

EXPLANATION OF PLATE XLII.

Africarion pallens?, Morelet (received as *Vitrina rüppelliana*, Pfr., Abyssinia, from Mr. R. Damon.)

Fig. 1. Animal: right side, × 2·4.
2. Ditto: left side, × 2·4.
3. Ditto: from behind, × 2·4.
4. Generative organs, × 4.
5. Buccal mass, salivary gland, &c., × 4.
6, 6 *a*, 6 *b*. Radula, × 340.
7. Jaw, × 12.

LAND AND FRESHWATER MOLLUSCA

OF

INDIA.

Part V.—MAY 1886.

(Plates XLIII.–LI.—*June* 1884.)

INTRODUCTION.

In order to keep the two great natural divisions of Land Mollusca distinct, the Helicidæ and the Cyclophoridæ, I have restricted this Part to the latter, for such an arrangement will much facilitate the work of the conchologist.

Drawings of the animal of *Cyclophorus* are given, but I do not now describe that genus in detail; the figures, although taken from spirit-specimens, serve to give a conception of the animal of the smaller genera now treated of.

I have selected species of *Alycæus* and *Diplommatina*, also *Rhaphaulus*, because it is a tube-bearing genus like *Alycæus*. In the 'Conchologia Indica' a number of species in the two first genera were left unfigured by Mr. Sylvanus Hanley, and the number of new forms has been largely increased by those since discovered: several of these are now figured side by side with their nearest allies, which, although before given in the above work, were figured in a very unsatisfactory manner. It has been suggested to me, and it would no doubt have been of more advantage to my work and secured a few more contributors, if I had given plates of new species selected indiscriminately from among all Indian genera of the Mollusca, and as soon after their discovery as possible. I have, however, deemed it best, in the true interest of conchology (so far as I can serve it), to continue to work out together closely allied genera, and thus eventually make the work as it progresses rather a collection of monographs of the different genera.

In Part VI. I shall revert to the Helicidæ, and continue the genera already treated of in the first four parts, leading on to the more slug-like forms, such as *Girasia* &c., intimately related to those already described.

[*Plates published June* 1884.]

Subfamily Diplommatininæ.

Genus Diplommatina.

Diplommatina, Benson, A. M. N. H. 1849, vol. iv. p. 193.
Carychium, Hutton, Journ. A. S. B. vol. iii. p. 85.
Bulimus, Pfr. Mon. Hel. vol. ii. p. 81 (1848).
Animal: Benson, A. M. N. H. April and June 1853; Blanford, A. M. N. H. 1867, vol. xix. p. 305. (Plate L. figs. 1 & 2, from nature.)

The first specimens of this genus were found in the N.W. Himalaya by that indefatigable collector Captain Thomas Hutton, a naturalist who, landing in India as a cadet with a limited knowledge of natural history, but with an intense love of it, worked in the early days of his service in that country under great difficulties, when books were not so easily obtained and when it was even rarer than now to meet any one with kindred tastes to stimulate the collector or add to his knowledge of the subject.

The Ann. & Mag. Nat. Hist. contains some interesting papers relative to the generic position this shell should hold, and even whether it possessed an operculum. This Mr. Gray was the first to discover; subsequently it was also detected and acknowledged by Captain Hutton. Benson (*l. c.*, June 1853, p. 433) was particularly positive as to its being an unoperculated form; and an amusing note by Hutton, appended to his copy of this paper which he gave me, shows that he (Benson) was very unwilling to acknowledge Hutton's confirmation of Gray's discovery.

Hutton placed his newly found species, from the supposed absence of the operculum and the position of the eyes, in *Carychium*, while Pfeiffer placed it in *Bulimus*, as from Bengal, possibly in error of the exact locality. Benson, however, in September 1849, quoting this erroneous generic identification and having examined the animals of two species, founded a new genus, which he described as follows:—

"Tentacula two only, originating from the upper part of the head, long and filiform; eyes situated on the posterior part of the tentacula at their base, composed of two lobes: one lobe deeply seated in the tentaculum and larger than the other lobe, which is a small black point coming to the surface on the outer side of the larger lobe; foot short.

"Had the animal been provided with an operculum, it might possibly have been referred to the family of Cyclostomatidæ in accordance with the position of the eyes, and the form of the aperture of the shell. The differences observable in the latter, as well as in its inhabitant, give countenance to a separation from *Carychium*; I therefore propose for the type the following name derived from the peculiarity of the percipient (*sic*) points or eyes.

" *Diplommatina*, nobis.

" Char. Gen. *Testa vix rimata, tenui, subovata; spira elongata; anfractibus convexis, costatis, ultimo subascendente; apertura edentula, subcirculari; peristomate duplicato, expanso; marginibus callo parietali appresso junctis; operculo nullo.*

" Sp. 1. *D.* (*Bul.*) *folliculus*, Pfr. Monogr. vol. ii. pp. 81–2. *Carychium costatum*, Hutt. MSS.

" Sp. 2. *D.* (*Carych.*) *costulatum*, Hutt. MSS."

In 1867, Mr. W. T. Blanford sent the following to the Annals & Mag. Nat. Hist., from Central India:—" I have more than once, within the last few years, called attention to the circumstance that, in the supplements to Dr. Pfeiffer's admirable monograph of the living operculated land-shells, the position assigned to the genus *Diplommatina*, close to *Acicula*, and in a suborder distinguished by the position of the eyes *above* the base of the tentacles, is not in accordance with the structure of the animal. For some years past I have not had an opportunity of reexamining the animal of any typical species of the genus. I am indebted to Captain Godwin-Austen for the accompanying outline sketch of the animal of a species of *Diplommatina* inhabiting the Western Himalayas near Masúri, and apparently a variety of *D. pullula*, Benson, which was first found by myself near Darjiling. This species is a typical *Diplommatina*, with strong costulation and a well-developed columellar tooth."

The animal is sketched as it appears just emerging from the shell (*vide* Plate L. fig. 2, from original drawing). The eyes, as will be seen, are distinctly lateral, as in *Cyclophorus*. I can trace no difference between the animal of this form and that of the smooth or spirally-ribbed species of the Indian Peninsula, which are by Pfeiffer classed as *Arinia*, in the neighbourhood of *Pupina*, in a different family, and even a distinct suborder from their nearest allies the typical *Diplommatinæ*.

Stoliczka (J. A. S. B. vol. xl. 1871, p. 152) has entered so fully into the subject of this genus and the many subgenera into which it has been divided, that there will be little new to say, after extracting all he has written.

Previously, in the same Journal (vol. xxxix. 1870), I gave, with drawings similar to those on Plate L. figs. 7, 7 *a*, 7 *b*, 7 *c*, 8, 8 *a*, of this work, a detailed description of that portion of the shell situated near the aperture and columella, which I now reprint:—

" In almost all the species of *Diplommatina* that I have examined, a constriction of the penultimate whorl is to be found, and in the larger species it is very well developed. This constriction of the whorl marks, of course, the position of the operculum when the animal is fully withdrawn into the shell, and the operculum of dead specimens is also to be found at this point. It would appear, from an examination of these shells, that the constriction also

marks the commencement of the formation of the columellar tooth. Behind the constriction the inside of the whorl appears thicker, and is much more polished; with the constriction this contracts, leaves the outer surface of the shell, and continues as a rim, like the sharp thread of a screw, running down and round the columellar margin of the peristome in the more or less blunt tooth-like process, characteristic of the genus. Situated also at the constriction on the roof of the whorl at this point may be seen a long tube-like ridge, very similar to the external tube of *Alycæus*, only that it diminishes from the back forwards. The position of the operculum, as regards both this and the lower rim, is at the back. It does not seem to me at all clear for what purposes this internal formation has been created. Possibly the extremity of the foot carrying the operculum travels along the screw-like thread, and the ridge above may give the necessary guiding surface to the operculum when the animal issues from the shell. The operculum, situated as it is so far from the aperture, would require some fulcrum or guiding-edges to pass it evenly and smoothly out of the shell."

On Plate L., in figures 7, 7 *a*, and 8, 8 *a*, I have endeavoured to show the position of the operculum and constriction, from the front, of *D. pachycheilus* and *D. blanfordiana*: where *t* represents the spiral rim; *c*, the position of the constriction; *r*, the upper ridge or tube.

Figs. 7 *b* and 7 *c* are respectively a side view and plan of the relative positions of the operculum and the commencement of the spiral rim.

The peculiar characteristics of *Diplommatina* are:—1. The very marked constriction of the penultimate whorl, situated generally above the aperture, in some species behind it, more or less distant. 2. In the short internal parietal rib just at the beginning of the last whorl, and in the twisted columella which terminates in the aperture with a tooth, sometimes placed so far internally as to be hardly visible, but very rarely becoming nearly obsolete. 3. The whorls are more or less transversely costulated, occasionally this is absent on the last two*. The first and last characters assimilate it to *Alycæus*, and the short internal tube or rib has also some resemblance, lying as it does close behind the constricted portion of the whorl. Compared with *Alycæus*, even with animals of the larger species, the eyes are comparatively much larger, and the tentacles are longer and more slender. It has not the burrowing habit of this genus, which perhaps accounts for this very marked difference of their development.

The teeth of the radula are generally so crowded together (Plate L. fig. 6 *a*), that only the central and the next lateral can usually be seen. However, on dissecting out several lingual ribbons, it occasionally happens that they become flattened out and separated (fig. 6). For a typical example of the radula and operculum in this genus I have selected the largest species as yet known, *D. in-*

* Species are found both dextral and sinistral over the whole range of the distribution of the genus.

signis, of the Naga Hills, which shows the central tooth to be 7-cuspid and the three laterals to be 5-cuspid. The formula being

$$\frac{3}{5\ .\ 5\ .\ 5}\quad\frac{-1-}{7}\quad\frac{3}{5\ .\ 5\ .\ 5}.$$

This radula is of very considerable length comparatively. See fig. 5, *r*.

The buccal plate (fig. 5) can be well seen in some specimens, and consists, not, as in the Helicidæ, of one solid horny mass with a cutting-edge, but of a multitudinous series of quadriform plates, slightly overlapping, and having a sort of tooth on the free angle, a modification of development really similar to that of the radula.

In this example (fig. 5) what I take to be otoliths were distinctly visible, situated in a sac near the base of the tentacles.

Operculum paucispiral, thin, shelly, brittle, and transparent.

Diplommatinæ are numerous where found, generally among decaying leaves, on which they are easily detected, and sometimes on the damp surface of limestone rocks they creep about in hundreds.

Species from the Western and Eastern Himalayas, &c.

Diplommatina blanfordiana, Benson. (Plate XLIX. figs. 10, 10 *a*.)

Locality. Damsang Peak, W. Bhutan Hills.

Diplommatina blanfordiana, Benson, A. M. N. H. 1860, vol. v. p. 460 (Darjiling); Journ. A. S. B. 1868, p. 83, pl. i. figs. 8, 8 *a*; Pfr. Mon. Pneum. vol. iii. p. 9; Theob. Supp. Cat. p. 41.

Diplommatina blanfordi, Bs., Hanley, Conch. Ind. p. 49, pl. cxix. figs. 5 & 6; Nevill, Hand-list, p. 267.

Original description:—" *Testa dextrorsa, foveato-rimata, ovato-acuminata, confertim arcuato-costulata, albida, spira ovato-pyramidata, superne attenuata, apice acutiusculo, sutura impressa; anfractibus* $7\frac{1}{2}$ *convexis, antepenultimo majusculo tumido, ultimo antice ascendente; apertura subverticali, late auriculari, plica columellari valida nutante munita, peristomate expanso, extus varice retrorelicta remotiuscula valida aucto, infra ad sinistram subangulato, marginibus callo parietali crasso expanso appresso junctis, columellari leviter sinuato. Operc.* —— ?

" Long $4\frac{1}{2}$, diam. $2\frac{1}{3}$ mill.

" *Hab.* prope Darjiling. Teste W. T. Blanford.

" Independently of its smaller size and stronger costulation, this shell is distinguished from *D. pachycheilus* by its foveate rimation behind the thin columellar lip, and by the retrorelict variciform second peristome, which is remote in its course, on the right side, from the thin actual peristome, but joins it below the umbilical

cavity. In *D. pachycheilus* the peristome is thickened and bifurcate at the insertion of the outer lip, and there is no remote varix; while the incrassate columellar lip is reflected over the rimation, and entirely conceals it. The last whorl ascends more conspicuously in front than in *D. pachycheilus,* although it rises considerably also in that shell—a feature which I omitted in the description given in the 'Annals' for 1857. The costulation of *D. pachycheilus* is very variable; in some specimens it disappears on the lower whorls, in others on the upper ones only; occasionally it pervades the whole surface."

It appears to be most abundant in the Western Bhutan Hills, judging from the numbers collected by Mr. W. Robert.

Diplommatina pullula, Benson. (Plate XLIX. fig. 12.) The specimen figured is from Mr. Blanford's collection and the typical locality.

Diplommatina pullula, Bs. A. M. N. H. 1859, vol. iii. p. 182; Godwin-Austen, Journ. A. S. B. 1868, p. 83, pl. i. fig. 7; Pfr. Mon. Pneum. vol. iii. p. 9; Hanley, Conch. Ind. p. 49, pl. cxix. fig. 7; Theob. Supp. Cat. p. 42; Nevill, Hand-list, p. 287.

Original description:—"*Testa imperforata, ovato-turrita, oblique confertim costulata, fulvescenti-albida, versus apicem rubella, spira subturrita, sutura impressa, apice obtusiusculo; anfractibus* 6–7 *convexis, antepenultimo tumidiore, ultimo antice valde ascendente, costulis remotioribus irregularibus; apertura subverticali, vix superne spectante, oblique obovali, peristomate duplici, interno porrecto expansiusculo, externo subreflexo, marginibus callo appresso expanso junctis, columellari verticali planato intus acute unidentato basi angulato-rotundato, dextrali valde arcuato. Operc.* —— ?

"Long. 3, diam. $1\frac{1}{4}$ mill.

"*Hab.* in valle Rungun, ad latus occidentale.

"In form and size between *huttoni* and *folliculus*, Pfr.; dextrorse like the latter, though agreeing with the former in having the tooth apparent on the columellar lip . . . . ."

Diplommatina huttoni, Pfr. (Plate XLV. figs. 7, 7 *a*, 7 *b*.)

Locality. Mussoorie, N.W. Himalaya (*G.-A.*).

Diplommatina huttoni, Pfeiffer, P. Z. S. 1852, p. 157; Guppy, A. M. N. H. 1867, vol. xx. p. 95; Blanford, A. M. N. H. 1868, vol. i. p. 110; Pfr. Mon. Pneum. vol. i. p. 123; Kust. and Chemnitz, Cyclos. pl. xlviii. figs. 36, 37; Hanley, Conch. Ind. p. 55, pl. cxxxix. figs. 5, 6; Theob. Supp. Cat. p. 42.

Original description:—"D. *testa sinistrorsa, subrimata, ovato-conica, eleganter confertim et oblique costulata, diaphana, albida; spira conica, acuta; anfract.* 6, *perconvexis; apertura subcirculari; perist. duplice, expanso.*

"Long. 2·5, diam. 1 mill.

"This little shell belongs to the genus *Diplommatina*, founded by Mr. Benson (Ann. & Mag. Nat. Hist. 1849, Sept.), on sufficient characters of the shell and of the animal, for *Carychium costatum*, Hutt., which I had erroneously referred to *Bulimus* under the name of *B. folliculus*. The genus seems to belong to the Auriculaceæ."

Size: maj. diam. 0·83, alt. axis 1·9 mm.

On a comparison of five specimens of *Diplommatina huttoni*, collected by myself at the typical locality Mussoorie, with eighteen specimens from Trinidad, said to be the same, kindly lent to me by Sir Rawson Rawson, I do not identify them as the same species, and I therefore further on describe the West-Indian form as *D. occidentalis*. The former is much more closely costulated, in proportion of 20 to 10, that is twice as many ribs on the antepenultimate whorl; the general form is different, particularly the much more expanded penultimate whorl in the Trinidad shell when compared with the flatter sides of *D. huttoni*. Still there is undoubtedly a very close resemblance, particularly in colour and texture.

The species from Trinidad was first brought to notice, identified as *D. huttoni*, in August 1867, by Mr. R. J. Lechmere Guppy, in the Ann. & Mag. Nat. Hist., and to the same periodical Mr. W. T. Blanford contributed a paper in February 1868 on this subject, and the occurrence also of *Ennea bicolor* in the same island. As all Mr. Blanford's remarks still hold good, as to distribution &c., and as it is difficult to condense with justice all that the author brings forward in support of his views, I give it *in extenso*, for it is a point of great interest as regards distribution. I have now shown that they are not the same species, and it remains to be discovered from what hill-district of India the Trinidad form has been conveyed, as I believe it was, together with *Ennea bicolor*, in the manner suggested by Mr. Blanford.

"*On the Occurrence of* Diplommatina huttoni *and* Ennea bicolor *in the West Indies.*

"In the 'Annals and Magazine of Natural History' for August 1867, Mr. R. J. Lechmere Guppy described the occurrence in Trinidad of *Diplommatina huttoni*, Pfr., and suggested that its presence and that of *Ennea bicolor*, Hutton, might be accounted for by supposing both to have migrated across the Tertiary Atlantis. I cannot help thinking that there are several circumstances opposed to this view; and in order to explain them it is necessary to describe the distribution of *Diplommatina huttoni* and *Ennea bicolor* in India.

"*Diplommatina huttoni* has hitherto only been found on the lower slopes of a portion of the Western Himalayas, near Masúri. It is true that the Himalayas have not been explored to a sufficient extent to justify the assertion that the shell does not exist elsewhere; but, as not a single Western Himalayan *Diplommatina* has as yet been found in those parts of the Eastern Himalayas about Darjiling which have been comparatively well explored, nor, *vice*

versâ, a solitary Darjiling species in the Western Himalayas, it is extremely improbable that the range of *D. huttoni* extends more than, at the outside, 200 or 300 miles along the base of the mountains. In the plains of India no *Diplommatina* has ever yet been found *. In the hills of Southern India, forms differing entirely from those of the Himalayas alone occur. The negative evidence, therefore, against the existence of *D. huttoni*, or of any other Indian species of the genus, over any large area of country is overwhelming. And this is entirely in accordance, as has been remarked by Mr. Benson, with the general facts of the distribution of operculated land-shells in India, none being met with over so large an area as species of the non-operculated forms frequently are.

"To the west of Hindustan not a single *Diplommatina*, or land-shell allied to *Diplommatina*, has ever been recorded. The genus and its allies are utterly unknown in Western Asia, Europe, and Africa. Not only are the Diplommatinidæ absent, but all their allies, the Cyclophoridæ, are equally so, with the exception of two or three obscure species in South Africa and of the anomalous genus *Craspedopoma* in the Azores, Madeira, and Canary Islands; and these few forms have at least as close an affinity to American types as to those of India.

"To the east and south-east of India the case is different. Species of *Diplommatina*, many of them sinistral, and of allied genera have been found in Burma, Labuan (*Opisthostoma de-crespignii*), the Philippine Islands (*Arinia*), the Moluccas, the Pelew Islands (*Palaina*), the New Hebrides, New Caledonia, Lord Howe's Island, Australia, and New Zealand. A species is said to occur also in the Sandwich Islands. Now, as *Megalomastoma* and *Cyclophorus* are common to the mainland of India, the Malay Archipelago, and the West Indies, it appears by no means improbable that *Diplommatina* may have the same distribution; and certainly, if *D. huttoni* ever migrated or was transported by natural causes from India to America, I cannot help thinking that it most probably traversed countries inhabited by its relations. But I cannot help doubting its having migrated at all over any extensive area.

"*Ennea bicolor* is a shell of much wider distribution. It is met with throughout the whole peninsula of Hindustan, and it also occurs in Burma. It lives in the plains, in cultivated land as well as in waste.

"It is easy to conceive that a mollusk with such habits might be very probably transported with living plants, or with roots or seeds. Mr. Guppy doubts whether the animals would survive the voyage from the East to the West Indies. Of this there can, I think, be no question. Mr. Benson, if I am not mistaken, has had specimens of *Diplommatina* alive in England; and there are very few Indian

* "I know of but one, doubtful exception—doubtful inasmuch as I do not know at what elevation the shell was found. This was in South Canara, on the Malabar coast. The form was one of the type peculiar to the hills of Southern India. The whole fauna of the coast of Malabar is peculiar." [Beddome has since found at least three species.—H. H. G.-A.]

shells which, when æstivating, will not bear a journey of several months without injury, provided damp or excessive cold be avoided.

"That the introduction of a single pair of shells is ample for the diffusion of the species has been proved in Calcutta in the case of *Achatina fulica*. The facts are well known, but will bear repeating. About twenty-five years ago, 1843, two specimens were brought from Mauritius, and placed in a garden. Now the species abounds almost everywhere throughout an area of at least five miles in length *. In many places several hundreds might be collected. Ten years ago, to my own knowledge, the shell was quite unknown in the Botanical Gardens on the opposite bank of the Hoogly. The other day I saw it living there in abundance. Of course, in a large city like Calcutta, where plants are constantly transferred from one garden to another at a distance, great facilities for dispersion exist; but the numbers, all unquestionably derived from a single pair in the course of so short a time, are nevertheless astonishing. I have very little doubt that one impregnated female would suffice equally well to introduce a species.

"Another fact in favour of *Diplommatina huttoni* and *Ennea bicolor* having been introduced into the West Indies by man is, that both are very small shells, precisely such as would most easily escape notice and be transported with plants. No shell is more likely than the *Ennea* to have been thus carried into foreign countries. The case of the *Diplommatina* is certainly far more difficult, but still it appears to me to present fewer difficulties than the theory of migration. Is there a botanical garden in Trinidad?

"If the *Diplommatina* has not been transported artificially, I should be almost inclined to suspect that the Trinidad species is not really identical with that inhabiting the Western Himalayas, but that two forms, closely resembling each other, have originated separately at the extreme limits of the area occupied by the genus.

"With regard to the *Ennea*, I have very little doubt of its having been transported. Many of the cultivated plants of the West Indies must have been introduced by the Spaniards and Portuguese, some of them, in all probability, direct from India; and the date of the introduction may thus have been sufficiently distant to allow of a considerable amount of dispersion amongst the various islands."

Diplommatina occidentalis. (Plate XLV. figs. 8, 8 *a*, 8 *b*.)

Locality. Island of Trinidad, West Indies (ex coll. *Sir Rawson Rawson*).

Shell sinistral, elongately turreted, scarcely sinuate; sculpture somewhat distant well marked costulation; colour white; spire rather attenuate, apex blunt; suture deep; whorls 6, sides tumid, the last small, the penultimate much the broadest, those above be-

* [In 1877 I found it abundant in the gardens at Barrackpur, which is 15 miles north of Calcutta.—H. H. G.-A.]

coming gradually swollen to the apex; aperture small, subvertical, round; peristome continuous, closely double; columellar margin weak, no tooth, the twist on columella seen within the aperture.

Size: major diam. 1·2, alt. axis 2·2 mm.
,, 0·05, ,, 0·09 inch.

Diplommatina theobaldi, n. sp. (Plate XLIX. figs. 11, 11 *a*.)

Locality. Darjiling (*Theobald*). Only one specimen.

Shell sinistral, globosely scarcely rimate, constriction central, above the aperture ovate, somewhat gibbous; sculpture smooth, with rather close costulation, high and sharp near aperture; colour pale umber; spire bluntly conoid, apex obtuse; suture moderately impressed; whorls 5, sides flat in front, rounded at back; aperture subvertical oval; peristome double, not continuous; columellar margin curved, no tooth visible viewed from the front, but seen slightly well within the aperture.

Size: major diam. 1·4, alt. axis 2·3 mm.
,, 0·06, ,, 0·09 inch.

This interesting sinistral species, the first I have seen from the Darjiling Hills, is another similar to *D. jaintiaca* of the mountains south of the Brahmaputra, but differs in many respects, particularly in its tumid small size and the absence of the columellar tooth.

Diplommatina daflaensis, n. sp. (Plate XLV. figs. 4, 4 *a*.)

Diplommatina austeni (large var.), Godwin-Austen, Journ. A. S. B. 1876, p. 179.

Locality. Dikrang valley, Dafla Hills (*G.-A.*).

Comparing this more closely with the form from the Khasi Hills (figs. 2, 2 *a*), it differs very much in its general shape, being much smaller below, the antepenultimate being much larger in proportion to the penultimate; the apex is more attenuate, and the sculpture differs. It must therefore be distinguished as a species.

Original description:—"Shell dextral, ovately fusiform, moderately thick, pale horny. Sculpture very fine, almost disappearing on the two last whorls. Sides of spire moderately flat. Whorls 7, penultimate and antepenultimate the largest, the last ascending slightly. Constriction in middle of aperture, which is circular and vertical; columellar margin rounded, tooth moderate. Peristome simple, double, rather strongly formed, the inner lip continuous. Alt. 0·15, diam. 0·70 in.

"*Hab.* Low down on the left bank of the Dikrang River; about a dozen were found.

"This shell is very similar in form to *D. austeni*, W. Blf., from the Khasi Hills, but it is much larger, that shell being only 0·90 inch in length, and the two last whorls are not so smooth and show slight traces of sculpture."

Species from Peninsular India.

Diplommatina gracilis, Beddome. (Plate XLVI. figs. 1, 1 *a*, 1 *b*.)

Diplommatina gracilis, Beddome, P. Z. S. 1875, p. 442, pl. lii. f. 2; Hanley, Conch. Ind. p. xii (index only); Theob. Supp. Cat. p. 42; Nevill, Hand-list, p. 288.

Size: alt. axis 2·7 mm.

Original description:—"Shell dextral, narrowly ovate, straw-coloured, not rimate; whorls $6\frac{1}{2}$, all except the apical or two upper ones rather distantly and prominently costulated, interstices smooth; spire rather slender, the fifth whorl the largest and projecting a little more than the penultimate, the penultimate with the constriction over the centre and right centre of the aperture; aperture reniform; peristome continuous round the penultimate whorl, prominently angled, below the tooth double, the outer lip expanded and reflexed, columellar margin nearly straight, the tooth prominent, a little deflexed: total length $\frac{1}{8}$ inch.

"Gudam Hills, Vizagapatam, 3000 feet elevation, 17° N. lat."

I notice a variety of this shell sent to me by Colonel Beddome from the Jeypur Hills, Madras, figured on Plate XLVI. figs. 2, 2 *a*. It has rather more tumid whorls and is less acuminate. In three out of eight specimens another point of difference is in the right margin of the peristome, which is sharply sinuate, as shown in fig. 2. The three specimens of *D. gracilis* from the Golcondah Hills do not show this. It is evidently only a more angulate form of the inner lip.

Diplommatina canarica, Beddome. (Plate XLVI. figs. 3, 3 *a*.)

Diplommatina canarica, Beddome, P. Z. S. 1875, p. 442, pl. lii. fig. 1; Hanley, Conch. Ind. p. xii (index only).

Size: alt. axis 2·5 mm.

Original description:—"Shell dextral, broadly ovate, scarcely or very inconspicuously rimate, flesh-coloured; whorls $6\frac{1}{2}$, convex, all except the apical obtuse one closely, regularly, and sharply costulated; interstices smooth; spire conical; the fifth whorl much the largest, and projecting much more than the penultimate; the penultimate with the constriction just in front of the centre of the circular aperture; peristome shining, continuous round the penultimate whorl, slightly canaliculate in its free portion below; columellar margin much incurved; the tooth prominent, slightly deflexed: total length $\frac{1}{10}$ inch.

"North Canara, in moist forests about Yellapore, 2500 feet elevation, 14° N. lat."

Diplommatina minima, Beddome. (Pl. XLIX. figs. 13, 13 *a.*)

Diplommatina minima, Beddome, P. Z. S. 1875, p. 442, pl. lii. figs. 3, 4; Hanley, Conch. Ind. p. xii (in list of species only); Nevill, Hand-list, p. 288.

The specimen figured is 1·4 mm. in height.

Original description:—"Shell dextral, cylindrical, straw-coloured, not rimate; whorls $5\frac{1}{2}$, convex, all except the two upper ones minutely costulated, sutures deep; spire black and tapering very slightly, the antepenultimate whorl not larger than the penultimate, the latter very slightly constricted; the position of the operculum over the centre of the aperture, aperture circular; peristome shining, continuous round the lower portion of the penultimate whorl, double in its lower free portion, the columellar margin semicircular, the tooth small but plainly visible under the lens: total length $\frac{1}{16}$ inch, $2\frac{1}{2}$ times the breadth.

"Gudam Hills, Vizagapatam, with the preceding (*D. gracilis*), but very rare. This is the smallest known species of *Diplommatina* true; it is quite a connecting-link between Semper's genus *Moussonia* (*Pupa problematica*, Mousson) and true *Diplommatina*.

"These are the first species of *Eudiplommatina* discovered in Southern India; the genus does not apparently occur on our western ghats south of 14° N. lat., where its place is taken by *Nicida*. Large tracts of the mountainous country in the Vizagapatam and Ganjam districts are conchologically quite unexplored; and other species will no doubt be some day discovered, particularly as *Nicida* is not found. On the Nallay-Mallay mountains, Kurnool district, 15° N. lat., I could not detect either *Diplommatina* or *Nicida*, though *Opisthostoma* was discovered; these hills, however, have been only superficially searched, and *Diplommatinas* will, I think, yet be found there."

Species from the Khasi and Naga-Hill Ranges.

Diplommatina polypleuris, Bs. (Plate XLV. figs. 1, 1 *a.*) From Khasi Hills; the same as figured in 'Conch. Indica.'

Diplommatina polypleuris, Benson, A. M. N. H. 1857, vol. xix. p. 203: Blanford and Godwin-Austen, J. A. S. B. 1868, p. 83, pl. iii. fig. 1 (from North Khasi).

Diplommatina polypleuris, var., Godwin-Austen, J. A. S. B. 1870, p. 4, pl. i. fig. 4 (from N. Jaintia, is distinct; I have named it *minuta*); Pfr. Mon. Pneum. vol. ii. p. 11; Hanley, Conch. Ind. p. 56, pl. cxl. fig. 10 (Sandoway, habitat doubtful); Theob. Supp. Cat. p. 42, Moulmein, Nattoung (both doubtful).

Diplommatina polypeuris, var., Nevill, Hand-list, no. 11, p. 285 (from Dafla Hills); = *minuta*.

Diplommatina polypleuris, var., Nevill, Hand-list, no. 11, p. 285 (from Sandoway and Nattoung), ? n. sp.

Original description :—"*Testa dextrorsa, non rimata, oblongo-ovata, confertim oblique chordato-costulata, pallide carnea, apice obtusiusculo, hyalino, sutura profunda ; anfractibus 6 convexis, antepenultimo tumidiusculo ; apertura verticali, subcirculari, dente columellari munita ; peristomate duplici, interiori expansiusculo, externo expanso, ad basin sinistram angulato-rotundato, callo parietali mediocri, appresso. Operc.* —— ?

"Long. vix 2, diam. 1 mill.

"This little species was found by Mr. Theobald at Nanclai Ponji, forty-five miles from Cherra, in 92° 30′ E. and 25° 15′ N."

DIPLOMMATINA AUSTENI, W. T. Blf. (Plate XLV. figs. 2, 2 *a*.)

Locality. North Khasi.

Diplommatina austeni, W. T. Blanford, J. A. S. B. 1868, p. 5, pl. iii. fig. 2.

Diplommatina austeni, large var., Godwin-Austen, J. A. S. B. 1876, p. 178, pl. vii. figs. 8, 8 *a* (is distinct); Hanley, Conch. Ind. p. 49, pl. cxix. figs. 1 and 4 ; Theob. Supp. Cat. p. 41 ; Nevill, Hand-list, p. 286.

Original description :—"*Testa dextrorsa non rimata, conico-ovata, albida vel succinea. Spira superna conica, non attenuata, sutura impressa, apice obtusiusculo. Anfr. 6, primi 3 gradatim crescentes, confertim minute costulati, ultimi lavigati vel costulis subobsoletis signati, antepenultimus major, ultimus aliquando lineis subdistantibus versus aperturam signatus, antice ascendens, subtus rotundatus. Apertura verticalis oblique subovalis ; perist. incrassatum, mediocriter expansum, duplex, margine columellari verticali, angulo aperto subtus desinente, basali rotundato, plica columellari mediocri, callo parietali expanso.*

"Long. $2\frac{1}{3}$, diam. 1 mill. ; apertura e perist. $1\frac{1}{6}$ mill. longa, intus $\frac{2}{3}$ lata.

"*Hab.* Cherra Poonji et Maotherichan in montibus Khasi (*W. Theobald et Godwin-Austen*).

"I some years ago received a specimen of this species from Mr. Theobald as *D. polypleuris*, Bens. On comparing the series of *Diplommatinæ* collected by Captain Godwin-Austen with Mr. Benson's description, it is evident that the type of that species belonged to a different form, found abundantly by Captain Godwin-Austen with the present species on the Maotherichan ridge, part of the northern scarp of the Khasi Hills, and distinguished from the present form by its much stronger sculpture, less conical spire, deeper suture, and rounder mouth. It is a smaller form. Mr. Theobald's type specimens of *D. polypleuris* were from Nanclai, also on the northern portion of the Khasi plateau. *D. austeni* varies con-

siderably in the sculpture of the lower whorls, which are in most specimens quite smooth. One individual sent is considerably more tumid than the type, but presents no other difference of importance."

Diplommatina saltuense, n. sp. (Plate XLV. figs. 6, 6 *a*.)

Locality. Jatinga valley, North Cachar Hills.

Shell dextral, not rimate, umbilicated, ovately fusiform; sculpture distant, strong costulation on all the whorls; colour ruddy ochre, strong on apex; spire conic acuminate, sides flat near apex, which is rather pointed; whorls $6\frac{1}{2}$, the three last much rounded, the antepenultimate the largest, the constriction in middle above the aperture; aperture circular, perpendicular; peristome very solid, double; columellar margin straight, the tooth pointed.

Size: major diam. 1·4, alt. axis 2·4 mm.
,, 0·06, ,, 0·10 inch.

This species, which assimilates in general form to *D. polypleuris*, &c., yet differs considerably in the attenuation of the apex and proportion of the whorls, being more like in this respect *D. daflaensis.* A considerable number were collected.

Diplommatina silvicola, n. sp. (Plate XLV. figs. 3, 3 *a*.)

Locality. Jenta Hajuma Peak, 5127 feet (*G.-A.*), North Cachar Hills.

Shell somewhat depressedly ovate, not rimate; sculpture, regularly well-marked distant costulation; colour pale sienna-brown; spire conic, sides convex, apex rather blunt; whorls 6, rounded, the last rather small, penultimate the most swollen, constriction in middle and above the aperture; aperture vertical, circular; peristome double and solid, columellar margin subvertical, tooth strong.

Size: major diam. 1·3, alt. axis 2·2 mm.
,, 0·05, ,, 0·09 inch.

I obtained only six specimens of this shell, in the dense lofty forest of the highest part of the North Cachar Hills. It approaches *D. austeni* in its general form, but is more depressed, and its sculpture is very defined.

Diplommatina silvicola, small var. (Plate XLV. figs. 5, 5 *a*.)

Locality. Jatinga valley, North Cachar Hills.

A shell which in general shape and sculpture is very similar to the last described was very abundant in the above valley, which drains from the Jenta Hajuma ridge. It is evidently a dwarf form, and measures only 1·7 mill. in height.

Species from Arakan, Burmah, and Nicobar Islands.

DIPLOMMATINA SPERATA, W. T. Blf. (Plate XLVI. figs. 5, 5 *a*.)

Locality. Moditoung, Arakan Hills.

Diplommatina sperata, W. T. Blanford, J. A. S. B. 1862, p. 143; Pfr. Mon. Pn. vol. iii. p. 10; Hanley, Conch. Ind. p. xii (index); Nevill, Hand-list, p. 284 (two sp., Mai-i, Arakan coast).
Size: alt. 2·7 mm.

Original description:—" *Testa dextrorsa, non rimata, ovato-conica, subfusiformis, solidiuscula, pallide cornea, subremote verticaliter costulata. Spira conica, apice acuta, sutura impressa. Anfr.* $6\frac{1}{2}$, *convexi; antepenultimus major, tumidus; ultimus antice vix ascendens. Apertura verticalis, subtus antice sinuata, late auricularis, plica columellari valida munita; perist. subduplex, expansum, margine columellari sinuato et ad basin angulo acuto desinente, callo parietali mediocri.*

" Long. $2\frac{1}{3}$, diam. $1\frac{1}{3}$, ap. diam. $\frac{1}{2}$ inch.
,, 0·09, ,, 0·05, ,, 0·02 mm.

" *Hab.* in montibus Arakan a Pegu secernentibus.

" But two perfect specimens of this shell occurred to me at Moditoung, on the Prome and Tongoop road, together with *Alycæus graphicus* &c. It resembles *D. pachycheilus*, B., in the shape of the mouth, but it is distinguished by the slighter rise of the last whorl and by its subremote costulate sculpture, which, together with its rounded aperture, serves also to distinguish it from *D. diplocheilus*, B., *D. pullula*, B., and *D. blanfordiana*, B., the two latter of which are closely costulated, and the first named smooth."

DIPLOMMATINA HENZADAENSIS, n. sp. (Plate XLVI. figs. 6, 6 *a*.)

Locality. Kyoung Gyoung Nulla, Henzada, Pegu.

Shell dextral, ovately turreted, scarcely rimate; sculpture rather distant, fine; spire, sides convex, apex blunt; suture well impressed; whorls 6, rounded, the antepenultimate the largest, the constriction being just above the upper outer margin of the peristome; aperture circular; peristome double, continuous, solid for size, columellar tooth well developed.

Size: major diam. 1·0, alt. axis 1·6 mm.
,, 0·04, ,, 0·07 inch.

There is only one specimen in Mr. Blanford's collection; but as it is fully grown, though so very minute, and is so unlike any thing before described from Pegu, I have ventured on figuring and naming it.

Diplommatina exilis, W. T. Blf. (Plate XLIX. fig. 1.)

Diplommatina exilis, W. T. Blf. J. A. S. B. 1862, p. 325; Pfr. Mon. Pneum. vol. iii. p. 10; Hanley, Conch. Ind. p. 49, pl. cxix. fig. 10; Theob. Supp. Cat. p. 42 (Mya-Leit Doung and Farm Caves, Moulmein; the latter locality refers to *D. exserta*); Nevill, Hand-list, p. 284.

Original description:—"Shell dextral, not rimate, very slenderly subfusiform, rather solid, moderately, closely, and obliquely ribbed throughout. Spire turreted, with straight sides, apex obtuse, suture impressed. Whorls 7½, rounded, antepenultimate slightly larger than the penultimate; lower whorl rising a little near the aperture, which is subvertical, slightly inclined downwards, almost circular, the columellar margin being straightened, terminating in a right angle at the base, and bearing a moderately sized internal tooth. Peristome double, the inner lip being prominent, slightly expanded, and continuous upon the penultimate whorl, but not forming a broad callus; outer lip slightly expanded, retrorelict. Operc. —— ?

Alt.	Diam.	Diam. ap.
3	$1\frac{1}{5}$	$\frac{2}{3}$ mm.
0·12	0·05	0·03 inch.

"*Habitat.* Mya-Leit Doung, Ava.

"The most slender species of the genus with which I am acquainted, and easily distinguished from all others by its long narrow form."

Diplommatina puppensis, W. T. Blf. (Plate XLIX. fig. 9.) The shell figured is from the typical locality.

Diplommatina puppensis, W. T. Blanford, J. A. S. B. 1862, p. 324; Blanford & Godwin-Austen, J. A. S. B. 1868, p. 83, pl. iv. figs. 2, 2 *a*; Hanley, Conch. Ind. p. 55, pl. cxxxix. figs. 8, 9; Theob. Supp. Cat. p. 42; Nevill, Hand-list, p. 284.

Diplommatina pappensis, Blf. A. M. N. H. 1864, vol. xiii. p. 443.

Original description:—"Shell dextral, not rimate, elongately subovate, thin, translucent, light amber in colour, very finely and closely costulated, spire with convex sides, apex pointed, not acuminate, suture impressed. Whorls 7, the antepenultimate being the largest, last whorl rising considerably upon the penultimate. Aperture vertical, nearly circular, the columellar margin being straight, with an obtuse angle at the base, and furnished with a small tooth internally. Peristome double, orange in colour; both lips expanded, the inner forming a thin callus upon the penultimate whorl. Operc. thin, horny, white, circular, flat, with no distinct spiral structure.

Alt.	Diam.	Diam. ap.
$3\frac{1}{2}$	2	1 mm.
0·15	0·08	0·04 inch.

"*Habitat.* Puppa Hill in Upper Burma, with *Alycæus vulcani.*

"The largest species yet discovered in Burma, and the most symmetrical, so far as I know, of all Asiatic forms. None of the Burmese representatives of *Diplommatina* show the strongly acuminate spire, or the great swelling of the antepenultimate whorl, which distinguishes the species inhabiting the Himalaya."

DIPLOMMATINA NANA, W. T. Blf. (Plate XLIX. figs. 6, 6 *a*.)

Diplommatina nana, W. T. Blanford, J. A. S. B. 1865, p. 85; Hanley, Conch. Ind. p. 55, pl. cxl. fig. 1; Theob. Supp. Cat. p. 42; Nevill, Hand-list, p. 285.

Original description:—"Shell not rimate, dextrorse, subovate, rather solid, amber-coloured, very finely and closely filiformly costulated on the lower whorls, less closely on the upper, or, frequently, subdistantly costulated throughout. Spire conical, with sides scarcely convex above; apex rather obtuse, sometimes reddish, suture impressed. Whorls 6–6½, rounded, antepenultimate the largest, the last rising considerably upon the penultimate. Aperture vertical, ear-shaped, nearly circular, columellar margin straight for a short distance and vertical, with an internal tooth. Peristome double, both portions expanded and appressed, the inner forming a thin callus upon the penultimate whorl. Operculum —— ?

	mm.	inch.
"Length	2¼	0·09
Diameter	1	0·04

"Aperture with peristome about ⅔ millim. in diameter.

"*Habitat.* Akoutoung, Thondoung, and Yenandoung in Henzada district, Pegu.

"This species approaches *D. polypleuris*, Bens., more nearly than any other. It is distinguished by its more regularly ovate form, blunter apex, less swollen penultimate whorl, and more marked and distant sculpture. The latter character, however, varies—the specimens from Thondoung, a hill about 20 miles south of Akoutoung, being either closely costulate throughout, or subdistantly sculptured above, closely below; while in Akoutoung specimens the costulation is subdistant throughout As, however, I can trace no other distinction between the shells, and the costulation varies in different individuals from each place, I do not think there is any specific distinction."

DIPLOMMATINA AFFINIS ?, Theobald. (Plate XLIX. fig. 3.)

Diplommatina affinis, Theobald, J. A. S. B. 1870, p. 398; Hanley, Conch. Ind. p. xii (index only); Theob. Supp. Cat. p. 41.

Locality. Upper Salwin valley (ex Theobald's collection).

Shell elongately fusiform, rimate; sculpture much worn, costulation close; colour bleached; spire turreted, attenuate towards apex; suture moderately impressed; whorls 7, rounded, antepen-

ultimate slightly the largest, the penultimate with constriction above the columellar margin; aperture subvertical, circular; peristome double, close, slightly developed, columellar margin with a small tooth.

Size: major diam. 1·0, alt. axis 3·0 mm.
,, 0·04, ,, 0·12 inch.

Mr. Theobald writes that the type is lost and probably smashed with some other shells in the same box. This specimen was referred to *D. affinis* by Stoliczka, and it agrees with the following original description:—

"*Testa dextrorsa, ovata, turrita, vix rimata; anfract.* 7, *regulariter crescentibus: transversim leviter striatis, ultimo antice valde ascendente* D. pullulæ *modo; apertura ovali, margine columellari recto, dente parvo instructo, labro duplici, extra expansiusculo.* Long. 0·18, lat. 0·08 unc.

"*D. pullula* differt magnitudine, spira minus attenuata et apertura magis rotundata.

"*Habitat.* Shan States."

Diplommatina pupæformis, Theobald. (Plate XLVI. figs. 4, 4*a*.) Shan States.

Diplommatina pupæformis, Theobald, Journ. A. S. B. 1870, p. 398; Hanley, Conch. Ind. p. xii (index); Theob. Supp. Cat. p. 42; Nevill, Hand-list, p. 285, as var. of *salwiniana*.

Original description:—"*Testa sinistrorsa, oblongo-ovali, non rimata, pallidissime cornea; sutura impressa; anfract.* 7, *regulariter crescentibus, transversaliter confertim striatis; apertura subcirculari, margine columellari brevi, recto, dente columellari modico instructo, labro duplici, margine externo expanso.* Long. 0·16, lat. 0·08 unc.

"*Habitat.* Shan States."

D. salwiniana must be exceedingly close, if it be not the same shell, as Stoliczka considered it. The original description runs as follows:—

"*Testa sinistrorsa, ovate turrita, non rimata, pallidissime flavescente, sutura impressa; anfractibus* 7½, *convexis, regulariter crescentibus, transversim distincte striatis, striis in ult. anfractu magis distantibus; apertura rotundate ovata, margine columellari recto, dente parvo submediano instructo, margine externo uniforme curvato, tenuiter calloso.* Long. 0·20, lat. 0·10 unc.

"*Habitat.* Shan States."

Diplommatina carneola, Stol. (Plate XLIX. figs. 8, 8*a*.)

Diplommatina carneola, Stoliczka, Journ. A. S. B. 1871, p. 152, pl. vi. f. 3; Hanley, Conch. Ind. p. 55, pl. cxl. fig. 4; Theob. Supp. Cat. p. 42; Nevill, Hand-list, p. 284.

Original description:—"D. *testa ovato-elongata, turrita, vix rimata, carnea, seu carneo-luteola; anfract.* 7, *valde convexis, suturis profundis junctis, primis duobus lævigatis, luteis, ceteris costulis obliquis,*

modice distantibus, ornatis, penultimo maxime inflato, ad terminationem valde constricto, ultimo minore, ad basin rotundato ; apertura rotundata, marginibus paulo dilatatis et incrassatis, ad anfractum penultimum conspicuiter ascendentibus, intus lævigatis ; labio adnato, paulo expanso, labro duplici, extus prope marginem costa tenui et acuta instructo, columella fere recta, infra dente unico instructa, ad basin vix angulata. Diam. anf. penult. 1·2 ; alt. tot. testæ 2·6, apert. alt. 0·8, ejusdem diam. 0·8 mm.

" *Animal carneo-luteolum, tentaculis, rostro ad terminationem interdumque dorso supero, plus minusve distincte atratis ; oculis magnis in latere basali tentaculorum sitis, atris, pede angusto, postice acuminato ; operculum corneum, tenuissimum, concentrice multispiratum.*

" *Hab.* Damotha, prope Moulmain.

" This species is somewhat allied to *D. puppensis*, Blf., differing from it by its constant smaller size, more tumid or convex and more widely costulated whorls, and by the aperture being at the columellar base rounded or nearly so, instead of deeply angular and canaliculate as it always appears to be in *puppensis*. The present species was found to be very common on the perpendicular limestone cliffs at Damotha, especially in localities where a little water trickled down the rock. The animals seemed to feed on minute algæ which were growing in the locality."

DIPLOMMATINA CRISPATA, Stoliczka. (Plate XLIX. figs. 4, 4 *a*, 4 *b*.)

Diplommatina (*Palaina*) *crispata*, Stol. Journ. A. S. B. 1871, p. 153, pl. vi. fig. 4 ; Hanley, Conch. Ind. p. 56, pl. cxli. fig. 6.

Palaina crispata, Theob. Supp. Cat. p. 43.

Original description :—" Diplommatina (Pal.) *testa conoidea, medio latissima, sordide albida ; anfractibus* 7, *primis duobus* (*rare* 1½) *mammillatis, lævigatis, convexis, sequente convexiusculo, confertim lamellose striato, ceteris medio angulatis, crasse lamellatis, lamellis crebris, inæqualibus, tenuibus, undulatis et crispatis, ad peripheriam angulosam spiniforme productis, latere interiore excavatis ; anfr. penultimo haud distincte constricto ; ultimo angustiore, basi convexiusculo ; apertura perobliqua, circulari, extra dilatata, intus continua, lævi, supra leviter adnata, ad latus columellare incrassata et infra dente pliciforme, vix distinguendo, instructa, margine interno acuto, undique libero ; peristomate externo tenui, lamelliforme undulato et late expanso.* Alt. testæ 2·5, diam. anf. penult. (spinis incl.) 1·5 ; diam. apert. int. 0·8, d. ap. cum perist. 1·0 mm.

" *Animal albidum, tentaculis cinereo atratis ; operculum corneum.*

" *Habitat.* Damotha, prope Moulmain ; rarissime cum præcedente.

" This is the first species from British India referable to the subgenus *Palaina* of Semper (*vide* Journ. de Conch. 1863, p. 291, and 1866, p. 348), although, if the subgenus should be retained, it cannot include all the species referred to it by its author."

Diplommatina angulata, Theobald & Stoliczka. (Plate XLIX. figs. 5, 5 *a*.)

Locality. Damotha, Moulmain.

Diplommatina angulata, Theobald & Stoliczka, Journ. A. S. B. 1872, p. 331, pl. xi. fig. 3 (Chouktalon Hill, south of Moulmain); Hanley, Conch. Ind. p. 55, pl. cxl. fig. 7 (not a characteristic drawing).

Palaina angulata, Theob. Supp. Cat. p. 43; Nevill, Hand-list, p. 285.

Original description :—" D. *testa ovato-elongata, dextrorsa vix rimata, sordide albida, anfractu penultimo latissimo, apice obtusiusculo, pallide rubido, submamillato ; anfratibus sex, primis duobus lævigatis, cæteris valde convexis, ad peripheriam plus minusve distincter angulatis, transversim confertissime costellatis aut acute striatis ; ultimo basi contracto ; sutura profunda, simplice ; apertura late circulari ; peristomate undique expanso, bilabiato, interno subrecto, ad marginem columellarem dente obliquo instructo, externo ad anfractum penultimum constrictum modice ascendente.* Long. 2, lat. maximus 0·8, diam. apert. 0·6 mm.

" *Hab.* prope Moulmain, provincia Martaban."

" The peculiar angulation of the whorls, combined with the very close transverse costulation, or almost striation, and the proportionately large aperture, readily separate this species from any other as yet known. Mr. Theobald obtained numerous specimens on the limestone hill near Damotha, and also south of Moulmain, together with *D. carneola*, Stol."

Diplommatina exserta, n. sp., Nevill. (Plate XLIX. figs. 2, 2 *a*.)

Diplommatina exserta, Nevill's Hand-list, p. 284, as *D. exilis*, var. *exserta*, from Farm Caves, Moulmain.

Locality. Damotha Cave, Moulmain (*Theobald*). Four specimens.

Shell elongately fusiform, not rimate; sculpture, minute spiral striæ, crossed by rather close transverse costulation, coarser and more distant on the apical whorls, less apparent on the last; colour very light sienna; spire high, turreted, sides flat, apex small; whorls 8, sides rounded, the antepenultimate the largest, the last ascending, constriction just behind the aperture; aperture vertical, oval; peristome closely double at base at right angles to the axis; columellar margin subvertical, the tooth not at all prominent, blunt and rounded.

Size: major diam. 1·0, alt. axis 3 mm.
,, 0·04, ,, 0·12 inch.

This shell is very like *D. exilis*, the constriction, however, is much more defined; there is no spiral striation on the surface of *D. exilis*, and there is great difference in the form and size of the columellar tooth. Its abnormal form serves to characterize *D. exserta* well, and it may be compared in this respect to *D. nicobarica*.

In the paper " Notes on Burmese and Arakanese Land-Shells," by W. Theobald, Esq., and Dr. F. Stoliczka (J. A. S. B. 1872, p. 331),

this species is referred to as follows:—"4. *D. exilis*, Blf., was found on the limestone hills at Damotha and at the Farm-Caves near Moulmain. Most of the specimens somewhat exceed in size those from Upper Burmah; the costulation of the whorls also is a shade finer, though variable in different specimens, and the outer lip of the aperture a little more expanded; however, the general form, character, and proportion of the whorls is exactly the same. One of the largest specimens measures: total length 3·2, diameter of penult. whorl 1·0, diam. of apert. with perist. 0·9 mm.; it has nine whorls."

Diplommatina edentula, n. sp. (Plate XLIX. figs. 7, 7 *a*.)

Locality. Moulmain (*Theobald*).

Shell ovately fusiform, not rimate, thin; sculpture minute, longitudinal striæ, crossed by distant strong costulation; colour whitish ochre; spire turreted, sides convex, apex rounded; suture moderately impressed; whorls 7, regularly increasing, the antepenultimate slightly the largest, the constriction above the aperture; aperture vertical, circular; peristome double, but not strongly developed; columellar tooth very small.

Size: major diam. 1·3, alt. axis 2·0 mm.
,, 0·04, ,, 0·08 inch.

This is another of the small, toothed, dextral forms from this locality, and it cannot be for a moment confused with *D. exserta*; it may possibly be the shell referred to *D. polypleuris* and said to have been found near Moulmain.

Diplommatina nicobarica, n. sp. (Plate XLVI. figs. 7, 7 *a*.)

Locality. Nicobars (*H. Godwin-Austen*).

Shell dextral, fusiform, not rimate; sculpture very close regular costulation; colour pale brown; spire, sides rather flattened, apex acuminate; whorls 7, sides convex, the antepenultimate the broadest, the constriction usually immediately above the aperture, but in some inclining more to the outer margin; aperture circular, suboblique; peristome closely double; columellar margin straight, only a slight indication of the usual tooth, but the thread or twist of the columella is visible within the aperture.

Alt. axis 4·3 mm.
,, 0·17 inch.

This species was sent me by my brother with numerous other shells; the absence of the usual columellar tooth is a conspicuous difference; it is the first species described from these islands. I note, however, in Nevill's 'Hand-list,' p. 284, that a species very similar to *D. carneola* was found by Stoliczka on Batti Malve, and also on Katchall Islands.

Subfamily Alycæinæ.

Genus Alycæus, Gray, MS., B.M.

Alycæus, Gray, Moll. Anim. & Shells Coll. Brit. Museum, 1850, p. 27; Benson, A. M. N. H. 1859, vol. iii. p. 176; W. T. Blanford, A. M. N. H. 1864, vol. xiii. p. 445 (as a distinct subfamily); Theob. Supp. Cat. 1876, p. 7 (subfam. Alycæinæ); Nevill, Hand-list, 1878, p. 290 (subfam. Diplommatinina).

Cyclophorus, sp., Pfr. Zeitsch. f. Malak. 1847, p. 108. no. 21.

Original description:—"Operculum horny, many-whorled. *Shell* conical. Spire regular. Last whorl distorted, compressed, much contracted before the mouth. Mouth circular. Peristome regularly reflexed." Type, *A. gibbus*, from Cochin China, the second and only other species recorded being *A. strangulatus*, from Landour, N.W. Himalaya, from the collection of Captain Boys. No mention is made of the peculiar and typical sutural tube.

Dr. Pfeiffer divided the species into two groups, "subturbinate" and "depressed;" but in 1859 Mr. Benson was the first to put the rapidly increasing species into systematic order, based on better characters, the principal being the position and extent and form of the constriction, shape of shell, and length of the sutural tube. Of these he formed three sections:—1. *Alycæus*, normal group, thus described: "The last whorl constricted somewhat remotely from the aperture, tumid on both sides of the constriction." It contains ten species, in four subdivisions. 2. *Charax*, Bs.: "Constriction broad, contiguous to the aperture, and divided more or less remotely from it, across the whorl, by a ridge which is hollow internally." There are six species given, divided again into three subsections:—

"* Ridge curved back remotely from the peristome . . . . *A. hebes.*
** Ridge parallel to and approaching the peristome . . . . *A. stylifer.*
*** Ridge parallel with and close to the base of the peristome . . . . *A. plectocheilus.*"

3. *Dioryx*, Bs. "Constriction narrow, and immediately behind the aperture; the sutural tube arising proportionally nearer to the peristome than in Sections 1 and 2." There are two subsections based on form of shell:—

a. *A. amphora*, Bs.

b. *A. crenulatus*, Bs.

This last, however, certainly belongs to Sect. 2.

As the sutural tube is one of the most important characters, I give what Benson very truly says of it:—"In estimating the length of the sutural tube, it is necessary to observe whether its brevity or mediocre size is permanent and natural, or due to decay or injury, especially in specimens which have become brittle from weathering.

In the species of which I have been enabled to examine a series, I find that the perfect tube is invariably of uniform length in each form. The character is so important, that I have thought it worthy of notice in the sectional arrangement." I can bear this out; hundreds of specimens may be taken of any one species, and the tube is invariably of the same length and form.

The above arrangement was a great advance towards a better knowledge of the genus; but in 1859 only about 20 species had been discovered, and as they began to multiply it was soon evident that the above three sections could not be so distinctly separated by any hard-and-fast line, and Sections 1 and 2 were soon blended.

In a little over 5½ years (1864) the number of species had mounted up to about 37, 31 being from the Indian area. And in this year Mr. W. T. Blanford published his most excellent paper in the 'Annals and Magazine of Natural History,' "On the Classification of the Cyclostomacea of Eastern Asia," and which must form the basis and starting-point of all future classification of the group; he arranged all the then known species in eight typical groups including *Dioryx*. Owing to the above author's subsequent observations, added to the valuable work done by Stoliczka in the same field, this requires to be somewhat modified. Many more species have been since discovered. Theobald's Supplementary Catalogue enumerates 56 (excluding *A. makarsæ*, G.-A., MS., never described), and 10 more, including those now described in this part, bring the number up to 66 that are known to me; while numerous species have been found in Siam, the Malay Archipelago, and several new species yet remain in my own collection.

If we take the more important characters of this very remarkable well-defined genus—such as: (1) the sutural tube; (2) form of the aperture, circular, angular, or crenulated, with varying peristome; (3) form of the constriction (most varied); (4) whorls, regular, compressed, more or less closely wound; (5) sculpture of whorls above and that adjacent to sutural tube; (6) operculum; and, lastly, the general form of the shell—we find Nature manipulates the above in every conceivable way with Geographical Distribution, and it becomes almost impossible to restrict a group by any very fixed boundaries, forms merging most beautifully one into the other; I shall not attempt, therefore, any fresh arrangement until many more have been figured.

Dioryx, restricted to such forms as *amphora*, *urnula*, &c., is one of the most distinct subdivisions that can be retained. The points of difference are its smooth globose form, position of constriction and operculum, and the long sutural tube.

Another well-marked section quite as worthy of subgeneric distinction is type ii. of Blanford; it would contain all those species like *constrictus*, Bs., and may be thus described:—Shell perforated, ovately conical; sculpture consisting of very fine, regular, close ribbing on the inflated portion of the shell; sutural tube very short, clubbed or pear-shaped.

The small size of the figures illustrating this genus in the 'Con-

chologia Indica' renders them often quite unsuited for reliable reference or make clear any specific classification, for very often only one view, and that not the most important, is given. In the case of plate ciii. the shells are represented from every possible point of view, and are positively wrong in detail. I therefore hope in time to figure the greater number of this genus in a similar way to those now given; and to do this properly it is necessary to give three views of each species, and sometimes four, to show clearly the differences that exist between such closely allied forms. It is a heavy task, and one that Stoliczka, with Mr. Blanford's assistance, had hoped to carry out in the whole family of the Cyclophoridæ. If I can accomplish a part of this work, it will, I trust, lessen the labours of future conchologists, and show how beautifully the law of Evolution is exemplified by these varying forms.

I have no drawing of the animal taken from life, as they are not easy to observe, being very shy about coming out. The eyes are small, and the tentacles not so long and thin as in *Diplommatina*. Plate LI. fig. 3 is taken from a spirit-specimen of *A. nagaensis*, enlarged four times.

The lingual ribbon given in fig. 4 is that of *A. bicrenatus*, one of the larger species, and very similar to *A. ingrami*. From this we find that in *Alycæus* the form of arrangement is

$$\frac{3}{4\ .\ 5\ .\ 5}\ \frac{-1-}{5}\ \frac{3}{5\ .\ 5\ .\ 4},$$

all the uncini being 5-cuspid, with the exception of the outer, on which I could only detect 4. It may be noticed that in the drawing the 5 cusps are not shown in every instance; but it must be remembered that they can only thus be seen owing to the toothed edges being strongly curved, both longitudinally and laterally. The uncini of this species are peculiarly spreading and fan-like, especially the first and second laterals.

There is a slight scar of a semicircular form present on the surface of the branchial sac, which corresponds in position with the internal orifice of the sutural tube. This indicates the rudimentary nature of the branchial tube in this genus. It is very short, and evidently by its margin the sutural tube is formed, for this shows successive layers of deposition. After the animal has reached a certain stage of development (and this stage is perhaps the corresponding one in *Diplommatina*, at the formation of the constriction) this ceases, and the whole anterior portion is formed by the edge of the mantle alone.

Alycæus bembex is a species with a very short but stout sutural tube; an examination of several species showed that close to the branchial chamber there is a divarication on the upper side, short and corresponding with the external tube, but opening into the chamber; the tube is completely closed on the other or posterior end. This must be homologous to the tube of *Streptaulus*.

It is somewhat difficult to understand how the formation of the sutural tube is effected. The position of the internal orifice, so different in *Rhaphaulus* and *Alycæus*, rather complicates the elucida-

tion, though it can only be a modification of the same inherited character. I have endeavoured from examination of the animal and shell in these two tube-bearing genera to understand how this difference can be produced, and on Plate LI. are figures and sections presenting internal and external views of these parts. Figs. 6 *a* and 9 *a* represent not the shell, but an ideal section through the mantle-margin and respiratory tube (fig. 7, *t*). In fig. 9 *a* the thick line represents the early stage, the dotted line the last stage of growth in *Rhaphaulus*.

It is easy to understand that any slight folding of the mantle, either on its internal or external surface, will produce a notch upon the peristome, such as we find in *Pterocyclos*, and that if this fold be increased so that the lower edges meet, a more or less circular notch or circular orifice will be produced, which, still retaining the shell-secreting property of the mantle, would deposit a tube. Then according as the mantle on its free curvilinear margin grew faster or slower than the tube or *pari passu* with it, so would the shelly tube be modified in form and position; or, again, the tube may increase or remain constant in length. Thus I imagine in *Rhaphaulus* the complete curvilinear edge of the mantle is slightly anterior to the free end of the tube, which has a continuous growth from its first formation, and thus the outer surface of the shell is formed over it up to the aperture, rendering the tube internal and its orifice posterior. At this stage the mantle-edge ceases to increase, the animal having reached its maximum development; this is stationary so to speak and the thickened peristome is then formed. The internal tube still continuing to grow at the free end passes upwards, backwards, or downwards externally, the common specific character.

In *Alycæus* the tube would appear to have a short but permanent length and position, and from the commencement of its formation, or folding in of the mantle-edge, is turned upward and backward over the edge of the peristome and slightly in advance of it, depositing the shelly tube externally upon the outer surface of the body-whorl and in the sutural angle, and is never internal. It should be noticed that the length of the tube in *Alycæus* bears invariably a constant relationship to the swollen, close, regular, and strongly ribbed portion of the body-whorl, and there is some intimate constructive connection between the two, indicating, I think, an intermittent action upon the line of the mantle-edge, during which it undergoes a change somewhat like the following. The part produced into a tube-like form is withdrawn, or reduced in size, on the formation of a rib which may be likened to an incipient peristomatic lip; on this being completed and the work of the mantle reduced, the fleshy tube is again produced, reflected over the margin to deposit a ring of shelly matter on the sutural tube, and then again retires during the formation of the next peristomatic ring.

When the animal approaches its mature size the fleshy tube becomes atrophied, leaving a mere scar on the mantle corresponding with the internal orifice, and here the above ribbing or close costulation ends. The portion of the whorl in front would then appear

to be formed more rapidly, and finally the thickened double peristome is completed. That the mantle-edge has a tendency to expand and grow, taking on a wavy outline, is shown in those species with deeply crenulated lips.

We have in the genera *Pterocyclos*, *Spiraculum*, *Rhaphaulus*, *Alycæus*, *Diplommatina*, and *Opisthostoma* that indication of continual development going on, and assuming great diversity of form after a certain stage of existence, which has been so often brought to notice in other groups of animals, showing that these shells are the more modified descendants of older and less specialized forms, that reached and brought their shell-constructing powers to an end at an earlier stage of growth. *Alycæus* with the shell cut back to the posterior end of the sutural tube and supplied with a thickened lip would be in all respects like many simple forms of *Cyclophorus*. *Rhaphaulus* would be a *Megalomastoma*. In *Diplommatina* the change would appear shown at the constriction of the last whorl.

Alycæus is essentially of a burrowing habit, and I have often obtained them quite deep in the moist soil; this is perhaps the reason of the eyes being so much smaller in comparison to those of *Diplommatina*. The shells when taken fresh are generally coated with a black clayey substance completely concealing the surface and its costulation. In favourable localities, among the deep layers of black decaying leaves, they are very numerous and easily found.

ALYCÆUS GEMMULA, Benson. (Plate XLVIII. figs. 4, 4*a*, 4*b*, 4*c*.)

Locality. Rungun Valley, near Darjiling (ex coll. *W. T. Blanford*).

Alycæus (*Charax*) *gemmula*, Benson, A. M. N. H. 1859, vol. iii. pp. 177, 179; Pfr. Mon. Pneum. vol. iii. p. 52; Hanley, Conch. Ind. p. 38, pl. xciii. fig. 7; Theob. Supp. Cat. p. 39; Reeve, Conch. Icon. 1878, pl. v. fig. 37.

Original description:—"*Testa umbilicata, conoideo-depressa, lævigata, nitida, ad ventriculum minutissime, ad umbilicum crasse striata, hyalina; spira conoidea, apice obtusiusculo, sutura profunda; anfractibus 4 convexiusculis, ultimo compresse rotundato, tum tumido, tubulum mediocrem gerente, tunc fossiculato-constricto, strictura crista recumbente, demumque area planata ab apertura separata; apertura obliqua, superne arcuatim prominente, peristomate duplici, valde incrassato-reflexo, intus superne ad angulum et infra ad basin leviter emarginato; umbilico profundo. Operc.* —— ?

"Diam. major $2\frac{1}{4}$, minor $1\frac{1}{2}$, axis $1\frac{1}{2}$ mill.

"Habitat rarissime in valle Rungun.

"Of this little shell the sole specimen obtained by Mr. Blanford was forwarded to me for examination. Its affinities are with the Khasia *A. hebes*; but it is perfectly distinct in colour, smaller size, sculpture, narrower constriction behind the ridge, narrower umbilicus, and in the emargination visible within the aperture at the lower part."

ALYCÆUS PACHITAENSIS, n. sp. (Plate XLVIII. figs. 5, 5*a*, 5*b*, 5*c*.)

Locality. Pachita village (Camp no. 7 of the Expeditionary Force, 1874–75), Dafla Hills, Assam.

Four specimens in my collection.

Shell depressedly turbinate, openly umbilicated, small; sculpture, apical whorls quite smooth, some distinct distant costulation on the posterior side of the last whorl, succeeded by very fine and close on the swollen portion of the same; colour dull whitish ochre; spire subconoid, apex blunt; suture impressed, the tube short; whorls 4, the last swollen, the constriction close to the sutural tube, slightly enlarging again midway between it and the peristome, and this portion quite smooth; aperture oblique, ovate, angular above and below; peristome double, thickened, with a well-defined notch below, columellar margin concave; operculum multispiral, horny, brown.

Size: major diam. 3·2, alt. axis 2·6 mm.
„ 0·13, „ 0·11 inch.

This shell finds its nearest ally in *A. gemmula*, Bs., of the Darjiling side, but the distinct ridge next the constriction is reduced to a mere even swelling of the whorl, and the peristome and form of aperture differ; it is also larger.

ALYCÆUS HEBES, Benson. (Plate XLIII. figs. 1, 1 *a*, 1 *b*, 1 *c*.)

Locality. Teria Ghat, south base of Khasi Hills.

Alycæus hebes, Benson, A. M. N. H. 1857, vol. xix. p. 204.

Charax hebes, Benson, A. M. N. H. 1859, vol. iii. p. 177 (type of subgenus).

Alycæus hebes, Pfr. Mon. Pneum. vol. ii. p. 37; Pfr. Novit. Conch. pl. xxxv. figs. 28–31; Hanley, Conch. Ind. p. 38, pl. xciii. figs. 5, 6; Theob. Supp. Cat. p. 39; Nevill, Hand-list, p. 290; Blanford, A. M. N. H. 1864, vol. xiii. p. 459.

Original description:—" *Testa umbilicata, solidiuscula, depressa, vix striatula, ad spatium inflatum et circa umbilicum confertissime striata, carneo-albida, apicem versus rubella; spira conoidea, apice obtusiusculo, sutura impressa; anfractibus 4 convexiusculis, ultimo ad latus gibboso, tubulum mediocrem suturalem gerente, spatio constricto costa valida retro recumbente munito; apertura obliqua, circulari; peristomate continuo, duplici, interiori porrecto, exteriori expanso, incrassato.*

" Diam. major 4, minor 3, axis 3 mill.

" *Hab.* ad Teria Ghát. Teste W. Theobald.

" This species occurs on rocks, and is distinguished by the structure of the aperture from the small Bornean *A. spiracellum*, A. & R. In the latter species, moreover, the rib behind and above the aperture is nearly parallel with the peristome, whereas in *A. hebes* it looks like a loop which had fallen backwards on the whorl. In both species it takes its rise at the right side of the peristome, and ends at the suture, corresponding with an internal sulcus."

ALYCÆUS NOTATUS, Godwin-Austen. (Plate XLIII. figs. 2, 2 *a*, 2 *b*.)

Locality. Toruputu Peak, Dafla Hills.

Alycæus notatus, Godw.-Aust. J. A. S. B. 1876, p. 176, pl. vii. figs. 9, 9 *a*, 9 *b*; Nevill, Hand-list, p. 291.

Original description :—"Shell globosely turbinate, narrowly umbilicated, of solid form; white, distant strong costulation on the upper whorls, close and fine ribbing on swollen portion of the last. Spire conoid, suture fairly impressed. Whorls 4½, closely wound, the last swollen, then sharply constricted, and again enlarged and descending, the expanded portion being marked with deep fold-like furrows. Sutural tube moderate, aperture oblique. Peristome very thick, distinctly treble in full-grown shells, outer layer terminating just behind the aperture, the inner continuous, the two outer much reflected near the umbilicus. Operculum smooth in front.

"Alt. 0·14, major diam. 0·17 in.

"*Hab.* On the slopes of Torúpútú Peak at 3000 feet, about 15 specimens collected.

"This is one of the most distinct and curious species I have as yet discovered, the fold-like indentations upon the expanded portion near the aperture having no counterpart in any other form with which I am acquainted. In other respects it is somewhat similar to *A. diagonius*, in the strong thick peristome and closely-wound whorls."

ALYCÆUS DAMSANGENSIS, n. sp. (Plate XLIII. figs. 3, 3*a*, 3*b*, 3*c*.)

Locality. Damsang Peak, Western Bhutan Hills (*W. Robert*).

Shell turbinate, very closely umbilicated; sculpture, well-marked distant costulation on the upper whorls, coarse, close, regular on the enlarged portion of the last; colour dull, very pale ochraceous; spire high, conic, apex blunt; suture moderately impressed, tube mediocre; whorls 4, the last sharply constricted at base of the sutural tube, then enlarging suddenly into a recurved ridge, succeeded by a depression, and then another shorter ridge, and a pit-like depression in front of it; aperture oblique; peristome double, but not thickened; columellar margin straight, subvertical, with slight notch below; operculum multispiral, brown.

Size: major diam. 3·8, alt. axis 3·2 mm.
,, 0·15, ,, 0·13 inch.

This shell assimilates somewhat, in the character of the constriction and the expansion of the whorl anterior to it, to *A. hebes*, Bs.; but in the irregular wrinkled portion in advance of the main ridge crossing the swollen part it differs very materially, and presents a most interesting approach to *A. notatus*, G.-A., of the Dafla Hills, the surface of which is more irregularly wrinkled and pitted; it is not so closely umbilicated, and the aperture is more angulate below. It appears to be a most abundant species.

ALYCÆUS CHENNELLI, n. sp. (Plate XLVIII. fig. 2.)

Locality. Piknúi, Naga Hills (*Chennell*).

Shell globosely turbinate, umbilicated, but very closely, as a narrow slit; sculpture, smooth near apex, distant costulation developed beyond, and strongest near suture; colour white; spire conic, high, apex rounded; sutural tube long, fine; whorls 4, rounded, constriction short and close to the base of the sutural tube, then

suddenly expanded, in a somewhat bell-shaped form, smooth, flatly convex in front, with a few very shallow indistinct wrinkles or pits; aperture very oblique, quadrate; peristome double, rounded on the outer lower margin, the columellar margin with a distinct notch; operculum smooth in front.

Size: major diam. 3·7, alt. axis 2·9 mm.
,, 0·15, ,, 0·12 inch.

This shell is allied to *A. notatus* and *damsangensis*, but the expanded part of the last whorl behind the aperture is smoother, with only an indication of wrinkling. It is more closely wound than the latter, and the aperture differs from both in its squarer form and angulation below (compare with the figures on Plate XLIII.).

Specimens from the Lhota-Naga Hills (fig. 2, Plate XLVIII.) differ slightly in being larger and in the expanded portion being more pitted and with little or no costulation towards the apex; these differences were found constant in 25 specimens, received by me from the late Mr. A. Chennell, after whom I have named this species. Deeply do I deplore, and I am sure all who knew him do the same, the early death of this excellent surveyor, who was one of the assistants in my Survey Party on the Assam Frontier. He was always to be depended on, and was possessed of great ability for the work, and tact and knowledge of the people. Combined with these official qualifications, he was a great lover of natural history, and a most ardent and admirable collector of birds, insects, and shells. My own collection and that of the late Marquis of Tweeddale were both greatly enriched by his indefatigable work. A fall in the rocky bed of a ravine, which occurred more than $2\frac{1}{2}$ years previously, injured him internally and ultimately affected the spine, and he died after great suffering in Bombay Harbour last October, on his return from a trip to Australia, where he had been for the benefit of his health.

Alycæus ingrami, W. T. Blf. (Plate XLIV. figs. 1, 1 *a*, 1 *b*, 1 *c*.)

Alycæus ingrami, W. T. Blf. J. A. S. B. 1862, p. 135; Pfr. Mon. Pneum. vol. iii. p. 48; Hanley, Conch. Ind. p. 38, pl. xcii. figs. 7, 10; Reeve, Conch. Icon. vol. xx. pl. vi. fig. 54; Theob. Supp. Cat. p. 39; Theob. J. A. S. B. 1871, p. 92 (is *ingrami*, var., a distinct and good species); Nevill, Hand-list, p. 292.

Locality. Tongoop, Arakan.

Original description:—“ *Testa late umbilicata, conoideo-depressa, acute sinuato-costulata, albida, interdum rubello-albida, versus apicem ferruginea, vix translucens. Spira conoidea, apice obtusula, sutura parum profunda. Anfr.* 4 *convexi, ultimus ad peripheriam sub compressus, ad latus mediocriter tumidus, ibidem confertissime costulatus, tum constrictus, prope aperturam non descendens. Spatium constrictum longitudinis mediocris, costulatum, medio tumidum; tubulum suturale mediocre, $\frac{1}{4}$ peripheriæ subæquans. Apertura obliqua, circularis; peristoma duplex; externo breviter incrassato-expanso; interno expaniusculo, continuo. Operculum fusco-corneum, multispirum, externe perconcavum, nucleo centrali intus prominente papillari.*

"Size: maj. diam. 6·0, min. 5·0, alt. $3\frac{1}{4}$, aper. diam. $1\frac{3}{4}$ mm.
„ 0·24, „ 0·20, „ 0·13, „ 0·07 inch.

"Habitat prope Tongoop, Arakan.

"The present belongs to the typical group of *Alycæus*, according to Mr. Benson, and is most nearly allied to *A. umbonalis*, B., from Pegu. It is distinguished from that species by its more raised spire, smaller size, shorter sutural tube, and shallower suture, by its less oblique mouth and non-descending last whorl, and by its duplex slightly expanded peristome, which contrasts strongly with the broadly reversed tip of *A. umbonalis.* That species also has the upper whorls much more closely, but less sinuously, costulated than are those of *A. ingrami.* In the subangulation of the last whorl at the periphery there is some resemblance to the little Thayetmyo *A. sculptilis*, B., which, however, is easily distinguished by the characters of its crenulated peristome, besides other peculiarities.

* * * *

"I have much pleasure in naming this form after Captain Ingram, to whom I am indebted for a very large collection of shells, chiefly from Arakan and the Arakan hills, and embracing altogether about 50 species, several of which had escaped my own search. *A. ingrami* was found in only one spot, viz. in earth, at the sides of a large mass of limestone about 3 miles S.W. of Tongoop. There it was abundant."

ALYCÆUS UMBONALIS, Benson. (Plate XLIV. figs. 2, 2*a*, 2*b*, 2*c*.)

Alycæus umbonalis, Benson, A. M. N. H. 1856, vol. xvii. p. 225; Pfr. Mon. Pneum. vol. ii. p. 36; Pfr. Novit. Conch. vol. i. pl. xxxv. figs. 18, 19, 20; Hanley, Conch. Ind. p. 38, pl. xcii. figs. 8, 9; Reeve, Conch. Icon. vol. xx. pl. iv. fig. 36; Theob. Supp. Cat. p. 40; Nevill, Hand-list, p. 293 (from Bassein, Thyetmyo, Arakan, and typical locality).

Locality. Akouktoung or Kyouktoung, on bank of Irawady River. In the Blanford collection there are seven species from the typical locality, one of which I have figured; there is one from Thyetmyo, smaller and more globose with higher spire, costulation coarser, and on the swollen part each rib is duplicate, and the peristome is thicker. Size, major diam. only 9·8, as compared with the largest from Akouktoung, which is 11·8. There are also two from the Arakan hills, east side, on the Tongoop road, 10·3 in major diam., quite like the type except that the peristome is rather better developed. From Mai-i, Arakan, I have a single specimen sent me by Stoliczka, similar to this species, but with a very short bent sutural tube, entire, not broken off; costulate throughout, but very distantly so near the apex. As I have only one specimen I can only consider it a variety, and perhaps an accidental one.

Original description:—"*Testa late umbilicata, depressa, subdiscoidea, confertim acute arcuatim costulata, cinereo-albida, apicem versus obtusulum, rubellum vel nigrum, rubescente; spira brevi, sutura profunda; anfractibus $4\frac{1}{2}$ convexis, ultimo ad latus, spiraliter rugoso-cancellatum, inflato, tum constricto, deinde tumidiusculo, tubulum retroversum, elongatum suturalem pone constrictionem gerente; aper-*

tura valde obliqua, circulari, undata, peristomate duplici, interiori continuo, expanso, nitidissimo, prope umbilicum sinuato, exteriori expanso, incrassato, ad anfractum penultimum breviter interrupto; umbilico perspectivo. Operculo corneo-fusco, multispirato, anfractuum marginibus scabre elevatis, extus profunde concavo, intus convexiusculo, nitidissimo, sulco marginato, umbone centrali papillari munito.

"Diam. major 10, minor 8, axis 5 mill.

"*Hab.* ad Akaouktoung, prope ripas fluvii Irawadi, nec raro.

"......The scabrous cancellation of the inflated part *only* of the last whorl is an unusual feature, no trace of the spiral rugæ appearing elsewhere on the whorls.

"The origin of the sutural tube is about 4 millimetres from the aperture. This shell has much affinity with the Bornean *Alycæus spiracellum*, A. & R., which has a somewhat similar operculum. Dr. Pfeiffer informs me that it is an *Alycæus*, and not a *Pterocyclos*, as conjectured by him before he had an opportunity of inspecting the shell."

ALYCÆUS NAGAENSIS, Godwin-Austen. (Plate XLIV. figs. 3, 3 *a*, 3 *b*, 3 *c*.)

Alycæus ingrami, var. *nagaensis*, Godwin-Austen, Journ. A. S. B. 1871, p. 92, pl. v. fig. 2; Theob. Supp. Cat. p. 40; Nevill, Hand-list, p. 292.

Original description:—"Shell depressedly globose, openly umbilicated, thick, slightly translucent, white, generally covered with a thin muddy coating, finely and sharply costulated throughout. Spire depressedly conoid, apex blunt, suture impressed; whorls 4, rounded, the last much swollen, constriction close to the base of sutural tube, slightly swelling again towards the mouth, quite smooth, sutural tube very long and thin. Aperture oblique, circular, peristome double, both lips close and slightly expanded. Operculum black, smooth, and concave in front, convex at back, with a central boss.

Maj. diam. 8·0, min. 6·8; alt. 5·0, diam. ap. 3·5, sut. tube 3·5 mm.
„ 0·32, „ 0·27; „ 0·20 „ 0·14 „ 0·14 inch.

"*Hab.* Neighbourhood of Asálú, rather local in its distribution, but there abundant.

"Its well costulated surface distinguishes it from the preceding variety of *A. ingrami*."

ALYCÆUS BRAHMA, n. sp. (Plate XLVIII. fig. 3.)

Locality. Brahmakund (*M. Ogle*).

Shell turbinate, umbilicated; sculpture very fine, longitudinal or spiral hair-like striæ, crossed by distant costulation, the ribs alternately very fine; colour whitish grey; spire high-conic, apex fine; suture impressed, the tube long; whorls four, well rounded, the swollen portion regularly ribbed for the length of the sutural tube, then blending gradually into finer costulation, the last suddenly flattened just within the umbilical region, constricted sharply just beyond the base of the sutural tube, then straight and cylindrical up

to the reflected inner lip; peristome oblique, crenulated on the outer lower margin, with four notches, solid, double, and much reflected; operculum multispiral, with a central dark depression.

Size: major diam. 5·0, alt. axis 4·0 mm.
,, 0·20 ,, 0·16 inch.

This shell in its simple straight portion of the whorl at the constriction shows a resemblance to the Asalu species figured by me in the J. A. S. B. 1871, fig. 3, which I then thought a variety of *A. ingrami*; but it is quite distinct, and the Asalu species I now name *A. bicrenatus.*

Genus Rhaphaulus, Pfr.

(Plate XLVII.)

Rhaphaulus, Pfr. in Novit. Conch. i. p. 75 (1856); Pfr. Mon. Pneum. vol. ii. p. 90 (1858); Stoliczka, J. A. S. B. 1870, p. 151 (animal).

Type *R. chrysalis*, Bens. A. M. N. H. 1856, vol. xvii. p. 342.

Original description:—"*Operculum tenuissimum, corneum, subangustispirum, extus concaviusculum. Testa umbilicata, pupinæformis; apertura circularis; perist. subduplex; internum continuum, externum dilatatum; ad insertionem marginis dextri canali aperto perforatum, canali suturali interno profunde in caverna spiræ desinente, utrinque pervio.*"

Pfeiffer had described this genus previously under the title of Anaulus, taking as the type *A. bombycinus*, Pfr., from Sarawak, Borneo (P. Z. S. 1855, p. 105); but he apparently did not retain it after creating the genus *Rhaphaulus.*

Benson afterwards founded the genus Streptaulus (A. M. N. H. 1857, vol. xix. p. 201), with *S. blanfordi* as type; it is thus described:—"*Testa umbilicata, pupiniformis, nitens; peristoma circulare, non continuum, superne tubulo suturali interno et externo, continuo, ad extremitates ambas aperto, siphonem mentiente, perforatum. Operc.* —— ?"

As the animal does not differ from that of *Rhaphaulus*, and as the chief point of difference is confined to a single character, the position and form of the sutural tube at its terminal end, *Streptaulus* cannot be considered generically or even subgenerically distinct. The form of this tube is most variable, even in the species *S. blanfordi*; in some, as var. *tubulus* or var. β, it is upright, like that of *R. chrysalis*; in var. *tortuosus* γ it is directed downwards as in *R. pachysiphon* and *assamica.*

Mr. Benson (Ann. & Mag. N. H., August 1859, p. 94) has described the animal of the genus *Rhaphaulus* and other genera from specimens sent home alive by Captain Haughton, then (in 1859) Magistrate of Moulmein, and by Captain Sankey:—

"Foot oblong, rounded anteriorly, narrowed posteriorly, and rounded at the extremity; muzzle short, declivous, rounded at the front, not emarginate nor lobed; tentacula somewhat short, slightly ringed, pointed at the summits and then slightly tumid, colour a

pale cinnabar-red; eyes small, jet-black, situated on tubercles, which are on the head, and joined to the outer base of the tentacula. The foot is greyish white, the sole pale, the muzzle a pale reddish buff-colour.

"The operculum, which is carried centrally on the hinder part of the foot, about midway between the shell and the tail, is capable of being withdrawn beyond the internal opening of the sutural tube, although ordinarily closing the aperture.

"There is no organ to be seen corresponding with the internal sutural tube, the animal in this respect exhibiting a similarity to that of *Pterocyclos,* which, as described by me in 1836, possesses no soft parts calculated to fill the anomalous portions of the shell near the aperture.

"Operculum very thin, horny, concave externally, consisting of $6\frac{1}{2}$ concave volutions with a varnished surface.

"For the single living specimen of this shell I am indebted to Captain R. H. Sankey, by whom it was taken in January. It remained closed in its shell until the 27th of June, when it began to yield slowly to the means employed to revive it, finally moving about and creeping freely under an inverted glass."

In 1863 Mr. Blanford had an opportunity afforded him of looking more closely at the animal preserved in spirit, and Mr. Benson's conclusions regarding the absence of any process analogous to the tube were found to be erroneous.

In Mr. Blanford's paper "On the Animals of *Raphaulus*, *Spiraculum*, and other Tube-bearing Cyclostomacea," Annals & Mag. Nat. Hist., July 1863, this subject is well discussed; and as our knowledge of the subject has not been increased since that time, I shall extract it in full:—

"No one can have examined carefully a collection of the operculated land-shells of India and South-eastern Asia without remarking the peculiar shelly processes of the peristome or suture which characterize several of the genera. Two principal forms of these processes may be distinguished, viz. (1) sutural tubes, either open at both ends or closed at one extremity, as in the genera *Raphaulus*, *Spiraculum*, *Opisthoporus*, *Alycæus*, &c., or, (2) incisions in the peristome—simple, as in *Pupina*, *Registoma*, &c., or accompanied by expansions of the outer lip, as in *Pterocyclos* and *Rhiostoma*. So far as I am aware, no soft parts have hitherto been observed in the animals of any of the above genera, corresponding to the peculiarities of their shelly coverings. During the past two or three years, I have examined carefully the animals of species belonging to the majority of the above-named forms; and in two instances I have ascertained the existence of an organization to which the processes of the shell are adapted, these two cases being in the genera *Raphaulus* and *Spiraculum*, which, although by no means nearly allied, agree in possessing a sutural tube opening both internally and externally.

"By the kindness of Baron F. v. Richthofen, I had, some time since, an opportunity of examining the animals of several specimens of the rare *Raphaulus chrysalis*, Pfr., from Moulmein in Burma.

The sutural tube in this species opens internally, a short distance from the peristome, by a small longitudinal slit, and then passes outside the suture to the aperture, where it is deflected upwards, and runs vertically for 2 or 3 millimetres on the exterior of the penultimate whorl, opening to the air at the extremity. I found this tube to be partly lined by a perforated process of the mantle, communicating internally, by means of a passage beneath the shell-muscle, with a very small orifice inside the air-chamber in the neck of the animal, and thus affording free access of the air to the pulmonary cavity, even when the mouth of the shell is hermetically closed by the operculum. The existence of this conformation cannot easily be observed during life*, on account of the manner in which the mantle lines the interior of the shell; but after killing the animal in hot water, and extracting it from the shell, the little free perforated process is distinctly seen, and is then about 2 millim. in length, its dimensions having been, doubtless, much contracted by the hot water.

"The genus *Spiraculum* of Pearson was established upon the species *S. hispidum*, P. By Dr. Pfeiffer that species has been referred to *Pterocyclos*, to which it is certainly nearly allied, although there appear to be good reasons for its generic separation. I have never had an opportunity of examining the animal of *S. hispidum*; but in the autumn of 1861 I met with a second species of the same genus in the neighbourhood of Ava (*S. avanum*, mihi). This species is furnished with a small tube similar to that in *S. hispidum*, opening at both ends, internally inside the body-whorl, close to the suture and at a short distance behind the peristome, and externally into the air, the short tube on the exterior of the whorl being free and curved backwards. The individual which I examined was just adult; there was no tubular process of the animal, but it was replaced by a deep notch in the mantle corresponding to the perforation of the shell. It is possible that, in older specimens, this notch may become altered into a more or less perfect tube; but, as the specimen examined was full-grown, this is scarcely probable.

"The other tube-bearing genera with open tubes are *Streptaulus*, which can scarcely be considered as generically distinct from *Raphaulus*, and *Opisthoporus*. I have not been able to examine the animals of either of these. The tube in the aberrant genus *Alycæus* opens anteriorly into the body-whorl by a longitudinal slit, as in the other genera; but after running back along the exterior of the suture for a greater or less distance, corresponding with the inflated portion of the last whorl, it is closed at the posterior termination. I have seen the soft parts of several species, including the comparatively large *A. umbonalis*, Bens., but have been unable to detect any organization corresponding to the shelly tube.

It was long since observed by Mr. Benson that no portion of the animal of *Pterocyclos* appeared to correspond with the peculiar

* "This is doubtless the reason that the tubular process of the mantle was overlooked by so careful an observer as Mr. Benson, who, I believe, confined his observations to the living animal. (See Ann. & Mag. Nat. Hist. ser vol. iv. p. 94.)"

incision of the inner, and cowl-shaped process or wing of the outer, peristome. I have examined two or three species * of that genus with precisely the same result. Amongst the Pupinidæ, I have examined the animals of a variety of *Pupina artata*, Bens., and of *Hybocystis gravida*, B., but I could detect no trace of any process similar to that in *Raphaulus*.

"The question of the use of these peculiar tubes in several genera of Indian Cyclostomacea, and the reason of their existence in only a few forms belonging to two different families (Cyclophoridæ and Pupinidæ) and by no means closely allied, has always appeared to me of considerable interest. The first and most natural suggestion which would occur to any one is that the tubes in question serve to supply the animal with air when the mouth of the shell is closed by the operculum. But, natural as this explanation seems, and despite its apparent confirmation by the discovery of the perforated process in the animal of *Raphaulus*, as described above, a very short consideration will show the difficulty of accepting it. For if additional means of breathing during æstivation are essential to *Raphaulus* and *Spiraculum*, how do forms so closely allied to them as *Pupina* and *Pterocyclos* contrive to exist without them? And this is the more inexplicable because there are modifications of the shelly portions of those genera which apparently represent the sutural tubes of *Raphaulus* and *Spiraculum*, the close relation of perforations in the body-whorl and slits in the peristome being shown by such genera as *Scissurella*, *Haliotis*, and *Stomatia*, *Fissurella* and *Emarginula*, &c. Above all, what explanation can be adopted for the tube in *Alycæus*, perforated throughout its length, but closed at its posterior termination?

"It is extremely probable that there is a connexion between the existence of the sutural tubes in the land-shells mentioned and the well-known siphon of *Ampullaria*, which genus, from its habit of æstivating in the dried mud of tanks, and its power of living for months without water, may almost be considered as an amphibious mollusk, and which approaches the Cyclostomacea most closely in the form of the animal. Another siphon-bearing species is *Camptonyx*, Bens., allied to *Otina*, which is by most conchologists classed with the amphibious Auriculaceæ, and I have recently obtained in Western India another generic type similarly furnished. It is closely affined to *Camptonyx*, being intermediate between that genus and *Succinea*. The two last-named shells æstivate attached to rocks. I am inclined to think it possible that links yet remain to be discovered between all the siphon- and tube-bearing genera, in which the peculiar organization, common under various modifications to all of them, is more clearly adapted to the animal's mode of existence than in the cases mentioned. It is extremely probable that such links may have existed and have become extinct. We can on this hypothesis easily conceive that their living representatives or, on the

* "Amongst others *Pterocyclos pullatus*, Bens., from Pegu, *P. nanus*, B., from the Nilgiris, and a species (a variety, perhaps, of *P. albersi*, Pfr.) from Arrakan."

theory of Darwin, their modified descendants possess the organization, in a more or less perfect condition, which was essential to their predecessors, but is no longer equally necessary to their own existence, and that, in short, the various apertural slits and imperforate tubes of *Pterocyclos*, *Pupina*, *Alycæus*, &c., must be regarded in the same light as rudimentary organs. By this hypothesis, also, we can understand the appearance of the more perfect conditions for communication between the atmosphere and the lung-chamber of the animal in widely separated forms, while others closely allied to each of them are more or less deficient in all traces of a similar organization, and the occurrence of a gradual passage from tube-bearing genera to others totally destitute of any modification of the peristome or suture is perfectly natural. The tube of *Spiraculum* becomes an incision in the peristome in *Pterocyclos*, the Burmese forms of which are closely allied to species of *Cyclophorus* like *C. calyx*, Bens., which have a thickened operculum and a minute rudimentary wing-shaped projection of the outer lip, close to the suture; and from these forms, again, there is a passage to discoid species, like *C. stenostomus*, Sow., with perfect peristomes. In the same way we may pass from *Raphaulus*, through *Pupinella* and *Pupina*, to *Registoma*, and finally to *Callia*, and through *Cataulus* to *Megalomastoma*. To the subject of the affinities of these various genera, however, and especially of the aberrant *Alycæus*, I hope to refer in a future communication."

RHAPHAULUS PACHYSIPHON, Theob. & Stol. (Plate XLVII. figs. 3, 3 *a*.)

Rhaphaulus pachysiphon, Theobald & Stoliczka, Journ. A. S. B. 1872, vol. xli. p. 329, pl. xi. fig. 1.

Rhaphaulus ——, Hanley, Conch. Ind. p. 53, pl. cxxxiii. fig. 4.

Rhaphaulus ——, Theob. Supp. Cat. p. 40; Nevill, Hand-list, p. 302.

Original description:—"R. *testa cylindraceo-ovata, anguste perforata, solida, fusca; spira obtusa, apice ad latus inclinato, excentrico; anfractibus* $5\frac{1}{2}$ *convexiusculis, transversim confertissime striolatis, ad suturam simplicem adpressis; anfractu penultimo sensim, ultimo valde, descendente, primo supra aperturam deplanato, altero ad suturam paulo constricto, ad basin convexiusculo; apertura fere verticali, circulari, peristomate pallide fuscescente, plane expanso atque crasso, supra ad anfractum penultimum labio attenuato et fere horizonti adnato, postice (aut supra) ad suturam tubulo crasso, deflexo instructo.* Long. 12·6, lat. anf. penult. 7·6, diam. apert. cum perist. 6·2, apert. int. 3·6 mm.

"*Hab.* prope Moulmain, valle Ataran fluminis.

"A rare and very distinct form from any of the other known species by its distorted spire and externally bent down sutural tube."

RHAPHAULUS CHRYSALIS, Pfeiffer. (Plate XLVII. figs. 1, 1 *a*.)

Cyclostoma chrysalis, Pfeiffer, P. Z. S. 1852, p. 158.

Anaulus chrysalis, Benson, A. M. N. H. 1856, vol. xiii. p. 342.

Rhaphaulus chrysalis, Benson, A. M. N. H. 1859, vol. iv. p. 94 (desc. animal and operculum); Pfr. Mon. Pneum. vol. ii. p. 92; Sowerby, Thes. Conch. pl. cclxv. figs. 6, 7; Hanley, Conch. Ind. p. 53, pl. cxxxiii. fig. 7.

Rhaphaulus chrysalis, Theob. Supp. Cat. p. 40; Nevill, Hand-list, p. 301.

Original description:—" C. *testa umbilicata, distorto-ovata, solida, striatula et punctato-malleata, fusco-carnea; spira irregulariter ovata, apice conoidea, acutiuscula; sutura levi; anfract.* 6, *convexiusculis, penultimo latere aperturali planulato, ultimo augustiore; apertura verticali, circulari; perist. crasso, dilatato, patente, reflexo, margine supero linea horizontali adnato. Operculum* ——? Long. 16, diam. 9 mill. *Hab.* Ava."

Stoliczka, in 1871, described the animal of this species as follows:—" I have only obtained a single live specimen at the Farm Caves near Moulmain. The animal was pale greyish white, with a slight fleshy tinge; tentacles rather long and pink; rostrum stout, the red oral parts shining through at its base; the frontal edge is slightly lobed. There is a regular canal leading from the pulmonary cavity backwards, then piercing the mantle and entering the tube, which runs again forward on the internal side of the last whorl below the suture, until it terminates in the external apertural tube. The form of this tube is different from that of *Pupina* or *Alycæus*, but it is very much the same as in *Streptaulus*."

RHAPHAULUS ASSAMICA, n. sp. (Plate XLVII. figs. 2, 2 *a*, 2 *b*.)

Locality. Brahmakhund (*M. J. Ogle*).

Shell elongately cylindrical, solid, rather tumid, flattened on the frontal surface of the penultimate whorl; sculpture regularly closely costulate; colour dull umber-brown; suture moderately impressed; whorls 6, penultimate the largest with sides flat, the next much smaller and convex; aperture perpendicular; peristome very thick, double, both continuous, but the outer only has a thin callus on the whorl.

The sutural tube has its origin on the upper outer margin close upon the outer lip, is colourless, and turns sharp downwards behind it, extending to nearly the height of the last whorl. This peristomial tube is not a tube in the strict sense of the term, but in section is semicircular, an arch outside resting upon the body-whorl, which forms the diameter. An inner sutural tube follows the suture backwards; it opens internally 3 mm. within the aperture, it is indistinctly shown on the exterior, but the lines of costulation extend over it, differing thus from what is seen in the similar tube in *Streptaulus blanfordi*, Bs.

Operculum horny, of 8 close-wound whorls; origin central.

Largest.	Size: major diam.	8·3,	diam. ap.	4·0,	alt. axis	16·75 mm.
	,,	0·33,	,,	0·16,	,,	0·66 inch.
Smallest.	,,	5·0,	,,	3·8,	,,	13·2 mm.
	,,	0·20,	,,	0·15,	,,	0·52 inch.

This shell is similar in general construction to *Rhaphaulus pachysiphon*, Stol. & Theob., from Moulmain, but it is considerably larger and the sutural tube terminates closer to the peristome, while in the latter it is separated from it.

Rhaphaulus blanfordi, Benson. (Plate XLVII. figs. 4, 4 *a*, 4 *b*, 4 *c*.)

Streptaulus blanfordi, Benson, A. M. N. H. 1857, vol. xix. p. 201; Pfr. Mon. Pneum. vol. ii. p. 92; Sowerby, Thes. Conch. vol. iii. pl. cclxv. figs. 8, 9; Godwin-Austen, Journ. A. S. B. 1876, p. 172, pl. viii. A. figs. 2, 3, 4; Hanley, Conch. Ind. p. 53, pl. cxxxiii. figs. 5, 6; Theob. Supp. Cat. p. 40; Nevill, Hand-list, p. 302.

Var. *α*. intubus, Godw.-Aust. l. c. pl. viii. fig. 3. (Plate XLVII. fig. 5.)

Var. *β*. tubulus, id. l. c. pl. viii. fig. 4. (Plate XLVII. fig. 6.)

Var. *γ*. tortuosus. (Plate XLVII. fig. 7.)

Var. abnormal. (Plate XLVII. fig. 8.)

Original description:—"*Testa umbilicata, oblonga, polita, regulariter oblique striata, striis prope suturam submarginatam fortioribus, lineis nonnullis spiralibus decussatis, fusco-cornea, translucente; apice obtusiusculo; anfractibus 5 convexiusculis, penultimo ventricosiori; apertura magna, subcirculari; peristomate simplici, reflexo, subrevoluto, marginibus callo parietali tenui junctis; tubuli suturalis parte externa longa, pone junctionem labri breviter arcuatim elevata, suturam subtus exhibente; umbilico impervio.*

"Long. $7\frac{1}{2}$, diam. 5 mill. Long. apert. (peristomate incluso) 4 mill.

"*Hab.* prope Darjiling, in montibus Himalayanis Sikkimensibus. Teste H. Blanford."

". . . . In *Streptaulus* the tube is first internal, and on arriving at the aperture is suddenly reflected, and instead of forming an opening in the lip above the aperture as in *R. bombycinus*, or ending in a short upright tube as in *R. lorraini* or *chrysalis*, Pfr., it describes a short arch behind the lip, and then runs to some distance along the external suture, as in *Alycæus*. In texture and colouring *Streptaulus* agrees with *Rhaphaulus*, not with *Alycæus*, and it is entirely deficient in the strangulation and swelling which characterize the anterior portion of the last whorl in all the species of the latter genus. It inhabits the same tract with *Megalomastoma funiculatum*. None of the larger Pupiform Cyclostomacea are known to travel farther towards the north-west."

EXPLANATION OF PLATE XLIII.*

Fig. 1, 1 *a*, 1 *b*, 1 *c*.	*Alycæus hebes*, Benson, × 7.	Khasi Hills.
2, 2 *a*, 2 *b*.	—— *notatus*, G.-A., × 7.	Dafla Hills.
3, 3 *a*, 3 *b*, 3 *c*.	—— *damsangensis*, G.-A., × 7.	W. Bhutan Hills.

EXPLANATION OF PLATE XLIV.

Fig. 1, 1 *a*, 1 *b*, 1 *c*.	*Alycæus ingrami*, W. T. Blf., × 2·4.	Tongoop, Arakan.
2, 2 *a*, 2 *b*, 2 *c*.	—— *umbonalis*, Bs., × 2·4.	Kyouk-toung, Pegu.
3, 3 *a*, 3 *b*, 3 *c*.	—— *nagaensis*, G.-A., × 2·4.	Asalu, N. Cachar Hills.

EXPLANATION OF PLATE XLV.

Fig. 1, 1 *a*.	*Diplommatina polypleuris*, Bs., × 12.	Khasi Hills.
2, 2 *a*.	—— *austeni*, W. Blf., × 12.	N. Khasi Hills.
3, 3 *a*.	—— *silvicola*, G.-A., × 12.	N. Cachar Hills.
4, 4 *a*.	—— *daflaensis*, G.-A., × 7.	Dafla Hills.
5, 5 *a*.	—— *silvicola*, small var., × 12.	N. Cachar Hills.
6, 6 *a*.	—— *saltuense*, G.-A., × 12.	N. Cachar Hills.
7, 7 *a*.	—— *huttoni*, Bs., × 12.	N.W. Himalaya.
7 *b*.	Apex of ditto, × 20.	[Indies.
8, 8 *a*.	*Diplommatina occidentalis*, G.-A., × 12.	Trinidad; West
8 *b*.	Apex of ditto, × 20.	

EXPLANATION OF PLATE XLVI.

Fig. 1, 1 *a*, 1 *b*.	*Diplommatina gracilis*, Bedd., × 12.	Vizagapatam, Madras.
2, 2 *a*.	—— *gracilis*, var., × 12.	Vizagapatam, Madras.
3, 3 *a*.	—— *canarica*, Bedd., × 12.	North Canara.
4, 4 *a*.	—— *pupæformis*, Theob., × 7.	Shan States, Burmah.
5, 5 *a*.	—— *sperata*, W. T. Blf., × 7.	Arakan.
6, 6 *a*.	—— *henzadaensis*, G.-A., × 12.	Pegu.
7, 7 *a*.	—— *nicobarica*, G.-A., × 12.	Nicobar Islands.

EXPLANATION OF PLATE XLVII.

Fig. 1, 1 *a*.	*Rhaphaulus chrysalis*, × 2·4.	Moulmain.
2.	—— *assamica*, G.-A., × 2·4.	Eastern Assam.
2 *a*.	Ditto, × 1·6.	
2 *b*.	Ditto: front view of aperture, × 2·4.	
3, 3 *a*.	*Rhaphaulus pachysiphon*, × 2·4.	Moulmain.
4, 4 *a*.	—— *blanfordi*, Bs., × 2·4.	Eastern Himalaya.
4 *b*.	Ditto: posterior termination of sutural tube, × 12.	
4 *c*.	Ditto: operculum, × 7.	[Himalaya.
5.	Ditto, var. *α. intubus*, × 4.	Dafla Hills; Eastern
5 *a*.	Ditto, ditto: aperture, front view, × 4.	
6.	Ditto, var. *β. tubulus*, × 2·4.	Dafla Hills.
6 *a*.	Ditto, ditto, × 4.	[Bhutan Hills.
7.	Ditto, var. *γ. tortuosus*, × 4.	Damsang Peak; W.
8.	Ditto, abnormal var., × 2·4.	Damsang Peak.

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* Plates XLIII.–LI. published June 1884.

EXPLANATION OF PLATE XLVIII.

Fig. 1, 1 *a*, 1 *b*, 1 *c*.	*Alycæus chennelli*, G.-A., × 7.	Naga Hills.
2.	—— *chennelli*, var.	Lhota-Naga Hills.
3.	—— *brahma*, G.-A., × 7.	Brahmakund.
3 *a*, 3 *b*, 3 *c*.	Ditto, × 4.	
4, 4 *a*, 4 *b*, 4 *c*.	*Alycæus gemmula*, Benson, × 7.	Darjiling.
5, 5 *a*, 5 *b*, 5 *c*.	—— *pachitaensis*, G.-A., × 7.	Dafla Hills.

EXPLANATION OF PLATE XLIX.

Fig. 1.	*Diplommatina exilis*, W. Blf., × 12.	Ava.
2, 2 *a*.	—— *exserta*, Nev., × 12.	Moulmain.
3.	—— *affinis*, Theobald ?, × 12.	Upper Salwin valley.
4, 4 *a*, 4 *b*.	—— *crispata*, Stol., × 12.	Moulmain.
5, 5 *a*.	—— *angulata*, Theob. & Stol., × 12.	Moulmain.
6, 6 *a*.	—— *nana*, W. T. Blf., × 12 and 7.	Pegu.
7, 7 *a*.	—— *edentula*, G.-A., × 12.	Moulmain.
8, 8 *a*.	—— *carneola*, Stol., × 12 and 7.	Moulmain.
9.	—— *puppensis*, W. T. Blf., × 12.	Upper Burmah.
10, 10 *a*.	—— *blanfordiana*, Bs., × 7 and 12.	Darjiling Hills.
11, 11 *a*.	—— *theobaldi*, n. sp., G.-A., × 12.	Darjiling.
12.	—— *pullula*, Bs., × 12.	Darjiling.
13, 13 *a*.	—— *minima*, Bedd., × 20 and 12.	South India.

EXPLANATION OF PLATE L.

Fig. 1. *Diplommatina oligopleuris*, W. T. Blf. Teria Ghat. Drawn from life, creeping and at rest. Enlarged.

2. *Diplommatina folliculus*, Pfr. Mussoorie. The shell held in the hand, showing manner of protrusion of the rostrum and the various forms the animal assumes. Enlarged.

3. *Diplommatina insignis*, G.-A., × 12. Spirit-specimen.

4. —— *blanfordiana*, Bs., × 12. Ditto. Western Bhutan. *f*, foot; *o*, operculum; *s.m*, shell-muscle; *b.c*, branchial sac.

5. *Diplommatina blanfordiana*, Bs., × 20. Portion of the head under slight pressure, showing:—*r*, radula; *b.p*, buccal plate; *t*, tentacle; *e*, eye; *o*, otolith ?; *m*, mantle.

5 *a*. Ditto: portion of buccal plate, × 360.

5 *b*. Ditto: otoliths ?, × 360.

6. *Diplommatina insignis*, G.-A.: portion of radula, × 360.

6 *a*. Ditto: ditto.

6 *b*. Ditto: central and lateral teeth of radula in different positions. Very much enlarged.

7. *Diplommatina pachycheilus*. Khasi Hills. Portion of the shell enlarged, showing the position of the operculum (*o*) and constriction (*c*) in the penultimate whorl, the internal parietal rib or lamella (*r*), and the columellar twist or tooth (*t*).

7 *a*. Ditto: ditto, another view.

7 *b*. Ditto: vertical section anterior to the operculum.

7 *c*. Ditto: horizontal section at the operculum, when withdrawn into shell to the full extent: the arrow shows the anterior side of same and direction towards the aperture; *col*, columella rest of lettering same as above.

8. *Diplommatina blanfordiana*, Bs., × 12. Darjiling. Showing similar constriction. Front view.

8 *a*. Ditto. Ditto. Viewed from side.

9. *Diplommatina insignis*, G.-A.: operculum, × 20.

EXPLANATION OF PLATE LI.

Fig. 1. *Cyclophorus aurora*, Bs., ♂, × 2·4. Animal from spirit-specimen. Damsang Peak, W. Bhutan Hills. *m*, the mantle drawn back, showing (*a.o*) the anal orifice and *p* the penis; *r*, the rostrum; *f*, sole of foot folded together; *s.m*, shell-muscle; *o*, operculum.

2\. *Cyclophorus aurora*, Bs., ♀, × 2·4. Spirit-specimen. Animal withdrawn into the shell. Viewed from the outer side of the aperture. Greater portion of shell broken away, showing foot folded together. Same locality.

2 *a*. Ditto: ditto, × 2·4. Viewed from the right side.

2 *b*. Ditto: ditto, × 1·6. Viewed from the left side, showing form of the mantle and the branchial cavity (*b.c*).

2 *c*. Ditto: ditto, × 1·6. Viewed from the right side, to show the shell-muscle (*s.m*).

2 *d*. Ditto: ditto, × 1·6. The mantle cut and opened back, to show the anal orifice and interior of the branchial cavity.

3\. *Alycæus nagaensis*, G.-A., enlarged. Animal from spirit-specimen.

4\. —— *bicrenatus*, G.-A. One row of the radula. Much enlarged.

5\. —— *bembex*, Bs. Sutural tube (*t*) of the whorl of the shell broken away, to show the internal orifice of the same (*o.t*).

6\. *Alycæus nagaensis*, G.-A., × 7. The outer right margin of the shell broken away, to show the sutural tube (*t*) in the internal orifice of the same (*o.t*).

6 *a*. Diagrammatic section of the frontal edge of the mantle (*m*) in *Alycæus*, by which the sutural tube is formed.

7\. *Rhaphaulus blanfordi*, Bs., enlarged. Animal removed from shell, showing the sutural or branchial tube (*t*).

8\. Ditto, × 7. Shell with margin broken away, to show the internal orifice (*o.t*) of the sutural tube (*t*), extending forward to the peristome.

9\. *Rhaphaulus blanfordi*, Bs., × 20. A portion of the shell near suture, to show the internal sutural tube (*t*) and the external sutural tube (*t'*), corresponding to that in fig. 7.

9 *a*. Diagrammatic section of the same across the front edge of the mantle (*m*), to illustrate the supposed formation of the internal and external sutural tubes (*t*, *t'*).

LAND AND FRESHWATER MOLLUSCA

OF

INDIA.

Part VI.—APRIL 1888.

(Plates LII.-LXII.—*September* 1887.)

INTRODUCTION.

In this Part I take up again the genus *Macrochlamys*, figuring some small species of the *M. petasus* type, and a very diverse group from the Kashmir and Punjab mountain area, represented by *M. flemingi*. Gray's genus *Girasia* next follows, and the very closely related subgenus *Austenia*, which I commenced in Part IV. p. 148, is continued.

The slug-like snails of Southern India will be found of extreme interest, and are included in *Africarion*, while there is also a remarkable new subgenus of *Girasia*, which I name Dekhania.

Through the kindness of Mr. J. B. N. Hennessey, of the Indian Survey Department, I am enabled to clear up the position of a species which had hitherto been uncertain, viz. *Bensonia labiata* of Pfeiffer (*Helix monticola* of Hutton); it is, I find, so close in its characters to the genus *Oxytes* that I consider *Bensonia* a good subgenus. The characters, as regards the animal, that differ much are the odontophore and form of the mucous gland, but the shell is very different to typical *Oxytes* of the Eastern Himalayan and Assam ranges. We thus have three divergent characters. When we remember the scores of molluscan genera founded on no other character than that of the shell, then for those conchologists who support the system of subgenera, *Bensonia* can stand as a subgenus of *Oxytes* and its Western Himalayan representative ; and I adopt this view instead of suppressing it. The more perfect we can build up our necessarily artificial classification of the animal kingdom the better ; and with this end in view I consider the forming of subgenera a most valuable aid as well as the adoption of named varieties or subspecies, it matters little what we call them, and it is only carrying the system a step further. It may not be so essential, or even

[*Plates published September* 1887.]

required at all in some groups as in others; but where modification of outward form exists, and also changes in the various internal organs, as in these Indian Mollusca, then gradation in classification can, with advantage, be extended beyond that of genera and species.

Characters seem to me like the strands of a plait made up of different colours, which are renewed from time to time, increased or decreased in number as they are worked into it; they run through a certain length of the plait, representative of time, each succeeded in turn by a new strand, the new character, which takes, as it were, the place of the other—yet not exactly, for each successive strand never holds the same position one to the other previously held; they are intermingled in every conceivable manner as the plait is extended—some are short, some long, some thick, others again fining away to mere threads. How very representative these threads or strands are of the altering character of allied forms, and how dimly, yet how distinctly, certain older characters are presented to us on close examination of all their parts! In the land-mollusca the characters given below are all of importance and should all be separately looked at before any attempt is made to assign a species to its proper genus, and, finally, to classify the genera with any degree of accuracy.

Characters.

External.	Internal.
A. Form of foot and its proportion in comparison to the shell or the mantle-lobes.	*a.* Radula.
A′. Mucous pore and other orifices.	*a′.* Jaw.
B. Mantle-lobes, form of.	*b.* Generative organs.
B′. Texture of epidermis, pedal line, and segmental groovings.	*b′.* Capreolus or spermatophore.
B″. Tentacles.	*c.* Other organs, renal &c.
C. Shell.	*d.* Retractor muscle attachments, of buccal mass, tentacles, &c.

Enough is now known of the above in genera of Indian Mollusca, so far as I have been able to examine and treat of them in this work, to place a few in relative position, and as near as we can do so in a lineal arrangement, in or near which it will not be difficult to intercallate those that have yet to be examined. This may be considered somewhat premature work; but as time goes on other interests arise, bringing different work, and good sight (so much needed for this kind of investigation) may fail, so that it is best to bring observations together before making any fresh departure.

MACROCHLAMYS (*continued from* p. 122).

Shells of small size, conoid or depressedly conoid, with smooth polished surface; whorls closely wound.

MACROCHLAMYS ? CONSEPTA, Benson. (Plate LIII. fig. 1.)

Macrochlamys consepta, Benson, A. M. N. Hist. 1860, vi. p. 190; 1863, xi. p. 320.

Helix consepta, Pfr. Mon. Hel. vol. v. p. 239.

Macrochlamys (sec. B) *consepta*, Theob. Supp. Cat. p. 19.

Nanina (*Macrochlamys*) *consepta*, Nev. Hand-list, p. 22.

Locality. Moulmain (*O. Limborg*).

Shell not umbilicated, discoid, flat on base, glassy, solid; sculpture none; colour pale ochraceous, with grey on the inner whorls; spire low, apex flat; suture shallow; whorls 7, closely wound, regularly increasing, rounded on periphery; aperture narrowly lunate, somewhat subangular on upper margin, subvertical; peristome thickened, sinuate below.

Size: maj. diam. 17·0, min. 15·8; alt. axis 6·3, body-whorl 5·3 mm.

For the original description see Part IV. p. 111.

MACROCHLAMYS ? WOODMASONI, n. sp., Nevill, MSS. (Plate LIII. fig. 2.)

Locality. Little Coco Island, Bay of Bengal.

Shell not quite mature, perforation minute, very depressedly globose, glassy, rather solid; sculpture quite smooth; whorls 6, closely wound, flat above, subangulate above on periphery.

Size: maj. diam. 9·5, min. 8·0; alt. axis 3·5, body-whorl 2·8 mm.

This shell is a small form of those closely wound shells represented by *M. resplendens* in Tenasserim. The animal of this last I have not yet been able to get, so that its true position in or near the genus I place it in has yet to be made out.

MACROCHLAMYS ? LATUS, n. sp. (Plate LIII. figs. 8, 8 *a*.)

Locality. Teria Ghat, southern base of Khasi Hills.

Shell discoid, umbilicated, solid, glassy; sculpture none; colour milky white or grey; spire low, apex convex; suture shallow; whorls 5, impressed, rounded on periphery, regularly increasing; aperture laterally ovate, not flat at upper margin; peristome thickened, very oblique on lower margin.

Size: maj. diam. 9·0, min. 8·5; alt. axis 3·4, body-whorl 3·0 mm.

I was at first inclined to think this the same as the next described shell, *M. hepatizon*, but the constancy of the form and size of the Teria-Ghat shell, its colour, and the very different form of aperture are distintive enough.

MACROCHLAMYS HEPATIZON, n. sp. (Plate LIII. fig. 3.)

Locality. Habiang-Garo Hills (*i. e.* the south-eastern side of that range).

Shell discoid, umbilicated, solid, base flat; sculpture none; colour pale liver-brown; spire very low, apex flat; suture very shallow; whorls 5, regularly increasing; aperture suboval, flat on the upper margin, subvertical; peristome thickened, sinuate below, very oblique from columellar margin.
Size: maj. diam. 14·0, min. 12·8; alt. axis 5·0, body-whorl 4·8 mm.

MACROCHLAMYS? HEPATIZON, n. sp. (Plate LIII. figs. 4, 4 *a*, 4 *b*.)

Locality. Toruputu Peak, Dafla Hills.

Shell umbilicated, discoid, glassy; sculpture short, microscopic longitudinal striæ, not continuous; colour pale sienna-brown, whitish below, with a stronger defined brown edging at the aperture; spire very low, apex flat; suture shallow, adpressed; whorls 5, flat above, rounded on periphery; aperture narrowly lunate, subvertical; peristome thin, very oblique on the columellar margin and but little reflected at the perforation, slightly sinuate below.
Size: maj. diam. 12·75, min. 11·2; alt. axis 4·8, body-whorl 3·8 mm.

MACROCHLAMYS? PETASUS, Bs. (Plate LIII. fig. 6.)

Helix petasus, Benson, A. M. N. Hist. 1859, iii. p. 388; Pfr. Mon. Hel. vol. v. p. 97.

Macrochlamys (sec. A) *petasus*, Theob. Cat. Supp. p. 18.

Nanina (*Microcystis*) *petasus*, Nev. Hand-list, p. 35.

Locality. Phie Than, Tenasserim (ex coll. *W. T. Blanford*)

Shell very narrowly perforate, globosely conoid, flat on base, rather solid, polished; sculpture indistinct transverse lines of growth, otherwise quite smooth; colour pale ochre; spire subdepressed, apex rounded, sides nearly flat; suture shallow; whorls 6, somewhat flatly convex above, rounded on periphery, closely wound; aperture lunate, nearly vertical; peristome thin; columellar margin oblique, nearly straight, not reflected.

Size: maj. diam. 11·5, min. 9·5; alt. axis 5·0, body-whorl 4·0.

A specimen from same locality (ex Indian Museum), sent me by Mr. G. Nevill, is identical. The animal of this species has not been examined.

Original description:—" *Testa perforata, orbiculato-convexa, radiato-striatula, nitida, translucente, cornea; spira brevi, convexiuscula, apice elevatiusculo, obtuso, sutura leviter canaliculata; anfractibus* 6, *convexiusculis, lente accrescentibus, ultimo ad peripheriam valde rotundato, subtus convexo; apertura subverticali, late lunata, peristomate intus ad marginem ipsum albo-labiato, margine basali arcuato, columellari ad perforationem brevissime reflexo.*

" Diam. major 10, minor 9, axis 4 mill.

" Var. spira convexiori: Diam. major $9\frac{1}{2}$, minor 9, axis $4\frac{1}{2}$ mill.

" Habitat ad Phie-Thán, vallis Tenasserim.

" A small polished *Nanina* of the vitrinoid type, notable chiefly for its shallow canaliculate suture, and for the labiation, which is so even with the edge of the lip, at the base, as to give a solid appearance to the shell."

MACROCHLAMYS SUBPETASUS, n. sp., Nevill, MS. (Plate LIII. fig. 7.)

Locality. Arakan Hills, west side (ex coll. *W. T. Blf.* No. 40, unnamed).

This is No. 137, 2nd var., of Nevill's Hand-list, p. 35, 12 sp., Arakan, ex coll. Dr. F. Stoliczka and W. T. Blanford, Esq.

Shell scarcely perforate, depressedly globose, polished, rather solid, flat on base; sculpture none; colour pale sienna-brown; spire moderately impressed; suture low, apex rounded; whorls 6, closely wound; aperture narrowly lunate; peristome rather thickened on the outer angle; columellar margin oblique, straight, strong.

Size: maj. diam. 7·8, min. 7·2; alt. axis 3·5, body-whorl 2·7 mm.

MACROCHLAMYS ? PATANE, Bs. (Plate LIII. fig. 5.)

Helix patane, Benson, A. M. N. Hist. 1859, iii. p. 270; Pfr. Mon. Hel. vol. v. p. 113; Mal. Blät. 1859, p. 22; Conch. Ind. p. 52, pl. cxxx. figs. 5, 6, 7.

Macrochlamys (sec. D) *patane*, Theob. Supp. Cat. p. 19.

Nanina patane, Nev. Hand-list, p. 27.

Locality. Darjiling (ex coll. *W. T. Blanford*).

Shell subperforate, globosely conoid, shining; sculpture smooth, with radiating, rather irregular, transverse ridges; colour pale dull ochre; spire rather high, sides very slightly convex; whorls 6, convex, rather closely wound; aperture semilunate, diagonal; columellar margin oblique, thin, but slightly reflected.

Size: maj. diam. 10, min. 9·2; alt. axis 5·0, body-whorl 3·4 mm.

Not having seen the animal of this species I cannot with certainty place it in the above genus.

Original description:—"*Testa perforata, subconoideo-depressa, tenui, fragili, radiatim rugoso-striatula, nitidula, diaphana, lutescente-cornea; spira depresso-conoidea, apice nitido, hyalino, obtuso, sutura impressa; anfractibus* 5, *convexiusculis, lente accrescentibus, ultimo antice leviter descendente, ad peripheriam rotundato-compresso, subtus convexiusculo, ad periomphalum excavato; apertura obliqua, transverse lunata, peristomate tenui, acuto, margine basali arcuato, columellari breviter expanso.*

"Diam. major vix 9, minor 8, axis 4 mill.

"Habitat ad Darjiling, rarissime.

"Allied to the Tenasserim *H. petasus*, B., but differing in its inferior lustre, irregular rugose sculpture, thinness, absence of labiation, and of margination at the suture. Mr. W. T. Blanford appears to have seen only the single specimen here described, and which, although taken in a dead state, is in fair condition."

With globose tumid *Vitrina*-like shells, the aperture large and expanded. Sculpture smooth, or with an irregular, wavy surface not amounting to ribbing.

MACROCHLAMYS FLEMINGI, Pfr. (Plate LIV.: animal, figs. 1, 1 *a*, 1 *b*, 1 *c*; shell, 1 *d*, 1 *e*.)

Vitrina flemingi, Pfr. P. Z. S. 1856, p. 324; Pfr. Mon. Hel. p. 790; Pfr. Novit. vol. i. pl. 28. figs. 1–3; Reeve, Conch. Icon. fig. 3.

Vitrina flemingiana, Hanley, Conch. Ind. p. 29, pl. lxvi. figs. 5, 6 (Scinde, this locality is very doubtful).

Helicarion flemingi, sec. D, Theob. Supp. Cat. p. 24; Nevill, Hand-list, p. 15; Nev. Second Yarkand Miss., Moll. p. 14.

Locality. Murree (*Theobald*), 6500 ft.

This is a species I had long wished to see, and again I am indebted to Mr. Theobold for the specimens I now figure and describe; the preservation by him of these forms in spirit has proved invaluable, and places another species in its true position.

Original description:—"V. *testa subdepressa, peripheria auriformis; solidula superne plicato-striata striisque spiralibus sub lente notata, æneo-micante, olivaceo-fulva; spira parum elata; sutura anguste albo-marginata; anfr.* $4\frac{1}{2}$, *convexiusculis, ultimo magno, infra medium obsoletissime angulato, basi lævigato, nitidiore; apertura diagonali, lunato-ovali, intus margaritacea; perist. simplice, margine dextro subrepando columellari arcuato, superne triangulatim reflexo, adnato.*

"Diam. maj. 33, minor 24; alt. 17-18 mill.

"*Hab.* Scinde, India (*Dr. Alex. Fleming*)."

This locality must be a mistake; I cannot believe a species so constituted could live in such a dry country or survive the long, rainless summer and its great heat, and the type is in every respect identical with specimens from the Murree Hills, Punjab.

The specimen figured measures:—Major diam. 34·5, minor 28·0, alt. axis 14·0 mm.

The animal (figs. 1 and 1*a*) on examination proves to be a true *Macrochlamys* and not a *Helicarion*, as supposed by some conchologists. The right shell-lobe is well developed, as well as the left shell-lobe, the left dorsal lobe being simple. The mucous pore (fig. 1 *b*) is large, the orifice not extending to the plane of the foot, and there is a very distinct overhanging lobe. The pallial line is very distinctly marked. The generative organs are almost identical with those of *Oxytes orobia* (*vide* Pl. XXXII.). The male organ has the same disk-like coil where the retractor muscle is given off. The kalc-sac is rather longer. The amatorial organ is very large. Most fortunately the spermatheca in the specimen examined was found to contain three spermatophores in a most perfect state of preservation—two empty, one full. These and those found in *O. labiata*, described further on, clear up a good deal of uncertainty which existed in my mind as to the form, when entire, and the exact

position of such fragments of these curious accessory organs as I have found from time to time when dissecting these spirit specimens, and which I have figured on Plates XXVIII., XL., and LXI. The spermatophore in this species consists of a very elongated bag 17 mm. in length, with a hard papillate head, fining out to a thin more or less bent rod. This bag or sack narrows gradually at the basal end, and is inserted into a long, hard, chitinous portion, which can best be likened to a long piece of house-guttering, which instead of being straight is curved, both sides of the gutter being fringed as it were with bifid spines. It is this hard portion which is commonly preserved and which one generally finds more or less broken up into short lengths. The pattern of the spines it is seen varies in different species, and gives us another character.

The Odontophore. The teeth are arranged thus:—

62 . 3 . 24 . 1 . 24 . 3 . 62
89 . 1 . 89

The central teeth tricuspid, as in the genus; the median bicuspid, the inner tooth much the longest. The outermost laterals very minute, bicuspid. Thus we find that although the generative organs are like species of *Oxytes*, the odontophore follows the type of *Macrochlamys*. The jaw has a large central projection on the concave side.

I have now before me six examples from Tundiani, near Murree, sent me by Mr. Theobald, the same as those referred to by him in his paper on the shells from that place, published in 1881. They are minutely, regularly, and spirally striate under a lens (like fig. 9, Pl. XXI.), the striæ being very sharply defined. He named them *H. austinianus*; but I consider they are only the young of *M. flemingi*. The description of the animal, which is that of a *Macrochlamys*, is fortunately given. The animal is furnished with a large mucous pore behind, and carries a long linguiform process of the mantle capable of extension to the apex, and is one of those species which, though so provided, does not possess a polished shell*. The texture of the shell (epidermis) is during life delicately sericeous, from the fine striation of the epidermis.

Size: maj. diam. 17·0, min. 13·8, alt. axis 7·0 mm.

Colour olive-green or olivaceous brown.

Macrochlamys altivagus, Theobald. (Plate LIV. figs. 2, 2 *a*.)

Helicarion flemingii, var. *altivagus*, Theob. J. A. S. B. 1878, p. 143.

Locality. Uri, Jhelum valley, below Baramula Kashmir (*coll. Theobald*).

Original description:—" Of this form I have only a few dead shells. The largest measures 31 × 23 × 14 mills., and it differs from the type by being much flatter. I only met with it sparingly above Uri."

* Compare this description with that of *H. flemingi*, var. *b*, given in the J. A. S. B. 1878, p. 143, which is certainly another species and genus.

Shell depressedly oval, not umbilicated; sculpture finely plicate, crossed by fine longitudinal striation, which is most marked near the apex; colour rich olive-green; spire very flatly conoid; apex blunt; suture shallow; whorls 4, the last much expanded; aperture ovate; peristome simple, columellar margin subvertical, not thickened.

Size: maj. diam. 31, min. 23; alt. axis 9, body-whorl 14 mm.

Animal not observed.

A small variety of *M. flemingi* (not *H. stoliczkanus*, Nevill, as named), from Damtour, near Abbottabad, I note in Mr. Theobald's collection, measuring major diam. 27·5, alt. axis 10·0, of a rich olive-green or olive-brown colour.

Macrochlamys cassida, Hutton and Benson. (Plate LIV. figs. 3, 3 *a*.)

Vitrina cassida, Hutt. & Bens. J. A. S. B. vol. vii. (1838) p. 214; Pfr. Mon. Hel. vol. iii. p. 2; Reeve, Conch. Icon. *Vitrina*, fig. 10 (from Benson's specimen); Hanley, Conch. Ind. p. 61, pl. clii. figs. 2, 3 ("The surface is dull, and shows in the type here figured, not merely concentric folds, but, also, some faint and distant spiral striæ").

Helicarion (sec. C) *cassida*, Theobald, Supp. Cat. p. 24; Nevill, Hand-list, p. 15.

Locality. Kashmir (*coll. Theobald*).

I am not at all sure, in figuring this species from Kashmir as *M. cassida*, that it is the same in every respect as the form described by Hutton and Benson from near Simla; it must be very close; but until I can obtain specimens in spirit from the typical locality I cannot be certain. The large size of the aperture of the shell rather points to a form like *V.* (? *Austenia*) *monticola* of Hutton, from Mussoorie. In fact until these animals are all hunted up in the place where they were originally obtained and described doubt will shroud any attempt at naming those from other parts of the Himalayas.

Original description:—No. 1, *H. cassida*, Hutton. "*Testa ovato-depressa, pallide cornea radiatim striolata, junioris epidermide sericea, ætate nitore orbata, anfractibus (penultima etiam intra aperturam) ventricosioribus; apertura patula, rotundato-ovata; spira convexa, apice exsertiuscula, minime obtusata; anfractibus 5, velociter crescentibus.* (B.)

"Greatest breadth 1 inch 2 lines.

"This shell has a more exserted spire than any other species known to the writers. This character, notwithstanding the great size of the aperture, coupled with the ventricose appearance of the penultimate whorl within the aperture, gives the shell an Heliciform air. It is very closely allied in habit to a species lately described from *Almorah*, but differs from it in its greater size and paler colour, and in the want of the polish which is observable in

the *Kumaon* shell. It equals in magnitude the *Sylhet* '*Vitrina gigas*,' from which singular macrostomatous species it altogether differs in form. (B.)

"At Simla it is not uncommon, during the rains or even after heavy showers at other seasons, creeping out from the holes of stone walls and the crevices of rocks, with the grey colour of which its own hue assimilates so much when concealed by its mantle, that it is not easily discovered. It occurs from *Bhar* to *Simla*, but most abundantly between the former place and *Subathú*.

"Animal varying in colours, sometimes pale brownish, at others dark grey. Two broad leaf-like processes, rising to a point, are spread over the shell when the animal is in motion, so as entirely to conceal it, and presenting the appearance of a large grey slug with a hump-back; a fleshy anal horn, as in the genus *Nanina*; foot very long; tentacula 4, the superior pair longest, buttoned at the tips and bearing the eyes. Orifice on the right side below the leaf-like process." This is the respiratory orifice, and the description of the animal shows that it is similar to *M. flemingi* of the Murree Hills. "Shell large, of 5 whorls, ventricose, suddenly increasing; the body-whorl forming nearly all the shell. Transversely wrinkled by the lines of growth; aperture transverse, ovate, broader than long, discovering the previous whorls; margin acute, interrupted on the body-whorl. Epidermis varying in colour from yellowish to olive-green. In young specimens lustrous when placed on its spire, the aperture appears as if the pillar-lip had been obliquely sliced off. The animal carries the shell horizontally on its back, the spire pointing upwards." (H.)

MACROCHLAMYS AUSTENIANUS, Nevill. (Plate LIV. figs. 4, 4 *a*, 4 *b*.)

Helicarion austenianus, Nevill, Moll. Second Yarkand Mission, p. 14, figs. 22, 24 (1878); Theob. J. A. S. B. 1881, p. 45; Nevill, Hand-list, p. 15.

Locality. Sonamurg, Kashmir (*Stoliczka*).

Original description:—"Shell much smaller than that of *H. flemingi*, more globose, suture more excavated, and the spire more raised, apex more distinct; more rudely and regularly concentrically plicated; whorls 5, more convex, the last one not nearly so much dilated; texture thinner and more membranaceous, of an equally dark but brighter and more glossy colour; aperture about as high as broad; base a shade more convex, imperforate; columellar less oblique, very short and abruptly triangularly reflected.

"Diam. $15\frac{1}{2}$, axis $7\frac{1}{2}$, apert. lat. $9\frac{1}{2}$, alt. $9\frac{1}{2}$ mm.

"Some dozen specimens, several of which are preserved with the animal in spirit, were brought back from Sonamurg, Kashmir." They were collected by Ferd. Stoliczka on his way to Yarkand with Mr. Forsyth's Political Mission.

The specimen figured is from the original locality. This lies on the extreme limits of the range of the Indo-Malayan molluscan fauna and the limit of forest north of Kashmir, near the water-

parting. Crossing the Zogi-La into the Ladak district of Dras there is a most complete change—one enters a sterile, dry country of higher elevation, altogether Tibetan in character. In a two days' march every shell belongs to the so-called European molluscan fauna. The specimen in my collection is smaller than the type, being major diam. only 13, and alt. axis 6·5 mm. The surface is smooth ; there is not the slightest trace of spiral striation, which specimens from Murree, assigned to this species, possess to a very marked extent.

Subgenus Girasia. (Plates LV., LVI., LVIII., LIX., LX., LXI., and LXII.)

Girasia, J. E. Gray, Cat. Pulm. Brit. Mus. p. 61 (March 1855).

Hoplites, Theobald, Journ. A. S. B. 1864, p. 244 ; Godwin-Austen, P. Z. S. 1880, p. 291.

Ibycus (very similar), described from an imperfect specimen by Heyneman, Malakoz. Blätt. (1862), p. 142, pl. i. fig. 3 (Darjiling).

Vitrina, Hanley, Conch. Ind. p. vi.

Helicarion (*Hoplites*, Austen ?), Pfeiffer, ed. Clessin, Nomen. Helic. Vivent. p. 30.

Parmarion, Nevill, Hand-list, p. 13.

The following original description is imperfect; no mention is made of the mucous gland, save in the synopsis of the generic section in which it is placed (*l. c.* p. 52) :—" Body united to the back of the foot, only separated by the convex hinder edges. Shell partly exposed, ovate, expanded, with a solid apex. Back of the neck (under the collar) with three grooves, the central groove between the tentacles double-edged ; the lateral one single, bent down on each side to the sides of the head at the back of the lower tentacles ; the head is only partly retractile, so that the base of the upper tentacles, which are completely retracted, are exposed on the top of the head like two perforations* ; the aperture of the generative organs is rather behind the base of the right tentacle. The hinder part of the body attached to the back of the foot nearly to its hinder end, which is separated from the deep concavity on the back of the foot by a deep lunate cross groove. In all these particulars the animal exactly agrees with the Portuguese species of *Drusia*"†.

Type *hookeri*, Gray. Khasi Hills, described further on.

Gray added three other species :—

1. "*Girasia ? rutellum*, Hutton, Afghanistan ; Kandahar. In April

* This describes the state of the spirit-specimen with the tentacles inverted as usual.

† It cannot have any relationship.

crepuscular." Which may be a *Parmacella*, for there is no mention of the mucous pore. It is thus described in J. A. S. B. 1849, p. 649; Arch. Naturg. 1852, p. 239:—"Animal bright gamboge-yellow, with four tentacles; posterior portion of the body behind the shell keeled; shield strengthened internally with a shovel-shaped shell of a pearly or nacreous appearance, obtuse and globose at the apex, with a deep sinus, covered with a thin, transparent epidermis, transversely wrinkled by the lines of growth; colour white. Length $\frac{1}{2}$, breadth about $\frac{1}{4}$ of an inch."

Since writing the above I have happily received from Mr. M. Ogle, of the Indian Survey Department, who has sent me many shells from time to time, a slug-like form from the ranges on the Kandahar and Khelat frontier. This, from its keeled foot and shovel-shaped shell, cannot be anything else than this species, *rutellum* of Hutton, or one allied to it. It has no mucous pore; it thus belongs to a group very distinct from *Girasia*. I have examined the animal; it is unlike any of the eastern forms with which I am acquainted, and must be put in a new genus, which I propose to call Candaharia, which I shall describe and figure later on.

2. *Girasia extranea*, Férussac. Habitat unknown. Hist. Moll. ii. 96.—"Shell a thin horny pellicle, without any appearance of a spire. Mantle with a circular opening showing the brownish pellicle. Foot truncated behind, with a subcaudal pore the whole length of the truncation, with a very strong keel above to the back of the shield. The body encased in a nick in the back." This agrees well with the form of the typical species.

3. *Girasia? problematica*, Férussac, Hist. Moll. ii. p. 96. Habitat unknown.—"Mantle much produced, forming a collar in front. Body convex and raised behind. Foot small, short. Shell yellow, convex externally, concave internally, like a half egg-shell."—*Deshayes*, from Férussac's figure. This is very unlike the type.

About the same period Fischer described the genus *Parmarion*, in the Actes Soc. Linn. Bordeaux, 1855. (The paper bears date June 1855, the part March 1856; so that Mr. Gray's title would have priority.) Fischer places in it the following species:—

infumatus, Fér. (Gray, Fig. Moll. plate 286. fig. 1). Hab? (Placed in *Drusia*, by Gray.)

extraneus, Fér. (Gray, Fig. Moll. plate 286. fig. 2). Hab.?

rangianus, Fér. Bourbon and Madagascar. (Placed in *Drusia*? by Gray.)

problematicus, Fér. (Gray, Fig. Moll. plate 286. fig. 4). Hab.?

From the drawing of *infumatus* by Férussac, one would be led to suppose that the shell is very rudimentary, and entirely concealed by the mantle-lobes. Unfortunately the habitat of this species and *extraneus* is unknown and never likely to be satisfactorily established.

Dr. Semper, in his fine work, Reis. Arch. Phil. 1870, p. 9, places in *Parmarion* two specimens, *pupillaris*, Humbert (*problematica*, Fér.?), from Java, and *extraneus*, Fér., obtained through

Herr Pierre, from Calcutta. I am in great doubts as to the correct identification of the latter species, which Semper figures on plate i. fig. 5. To my knowledge no forms like the Khasi-Hill *G. hookeri* have ever been taken in the country around Calcutta. If it was found in the Botanical Gardens there, it may have been brought from up the country in baskets of plants. Several imported species have been in this way introduced there from time to time; and some may have become established. Again, although sent from Calcutta it may not have been taken there.

Von Martens, in his account of the Land Shells in "Die Preussiche Expedition nach Ost-Asien," follows Fischer, placing the Javan forms in *Parmarion*, and describes at length *P. pupillaris*, Humbert (pl. 5. figs. 7–8, animal; and pl. 12. fig. 3, shell), with its three varieties *punctata*, *marmorata*, and *vittata*. There are also *tæniatus* and *reticulatus*, Hasselt; *luteus* and *planus*, Mousson. These Javan mollusks are evidently extremely close to the Burmese and Indian forms, and may eventually have to be included in *Girasia*.

Nevill in his Hand-list of the Mollusca in the Indian Museum, Calcutta (1878), adopts *Parmarion* for two typical forms of *Girasia* from the Khasi Hills, *croceus* and *brunneus*.

The subgenus *Hoplites* was proposed for the Khasi-Hill slug-like forms by Mr. Theobald; but he gave no description of the genus, nor did he indicate the species, beyond saying it was 2 inches long, from Teria Ghat. It was probably my *H. theobaldi*, P. Z. S. 1872, p. 517, = *G. hookeri*.

The following will be an emended description of the genus as presented in the typical species:—

Shell rudimentary, horny, narrow, elongate, of one simple whorl; colour olivaceous, apex white, the central portion of the inside of the shell covered with a milky-white callus. About 1 inch long. (Plate LV. figs. 2, 2 *a*, 2 *b*.)

Animal slug-like, long, mantle largely developed; shell and dorsal lobes are united all round; and the shell is entirely covered by the former, with the exception of a narrow area on the posterior left margin. From the anterior right margin of this area a well-marked cicatricial line runs forward to just above the respiratory and anal orifice, and marks the usual distinct division of the shell-lobes in *Austenia* and *Durgella*, and their complete separation, as in *Macrochlamys*, into a left (frontal) and right (posterior). The dorsal lobes are divided diagonally forward from the respiratory orifice into a large left dorsal lobe and (behind and adjacent to the orifices) a smaller right dorsal lobe; on the extreme posterior side a slight beading marks the junction of these lobes with the shell-lobes above. This portion of the animal is sunk into a deep V-shaped, smooth, and unwrinkled depression in the back, where the dorsal ridge of the foot terminates suddenly. Extremity of the foot truncate, with a large linear mucous gland; the pedal line is very distinct.

Genital aperture near the lower and outer base of the right tentacle.

The foot is divided longitudinally into three subequal median and

lateral areas, and is distinctly segmented, the major divisions on the pallial edge of the foot being continued in V-shape from one side to the other, the angle being directed backwards in the spirit-specimen; but they are no doubt straight when the animal is alive.

These mollusks are abundant during the rainy season in Assam and other parts of the adjacent country, but in the cold weather are very difficult to find, and then only under stones and logs in damp, low situations. Some may be found on rocks and on the boles of trees in the forest. One species, *G. croceus*, I found crawling over the tall grasses 12 feet from the ground; and I should not have seen it, only that I was hunting for some butterflies at the time which were flying about high over the jungle.

GIRASIA HOOKERI, Gray. (Plate LV. figs. 1, 1 *a*, 1 *b*, animal; 2, 2 *a*, 2 *b*, shell; and Plate LXII. figs. 1, 1 *a*.)

Girasia hookeri, J. E. Gray, Cat. Pulm. Brit. Mus. p. 61 (March 1855); Godwin-Austen, P. Z. S. 1880, pp. 291, 292, 294, pl. xxvii. figs. 2, 3, 4.

Hoplites theobaldi, G.-Austen, P. Z. S. 1872, p. 517.

Original description:—"Shell oblong, elongate, slender, arched concentrically, very thin, horny, wrinkled; thicker, but equally horny, in the upper part of the centre; the apex thick, white, solid, suboblong, elongate ear-shaped, with a lateral submarginal spire of half a whorl.

"*Hab.* India, Khasya (*Dr. Joseph Hooker*)."

The living animal is of a pale yellowish dull grey, under surface of foot pale light yellow. The mantle-lobes completely cover the shell; a whitish stripe extends from the posterior side forward along the edge of the left lobe; and a like narrow stripe from the hinder part of the mantle is continued to the respiratory orifice on the right side. The animal is in all points of structure similar to *H. croceus*, but larger by ½ an inch; the shell is very rudimental, major diam. 0·56, minor very narrow; the apex is well developed and more calcareous, the rest of the shell being a mere thin horny epidermis of a pale green colour.

This specimen was from Masjerri, N.W. Khasi Hills. Another is described in my notebook as follows:—

Length 3·3 inches, of a pale brown colour. Tentacles 0·2 inch in length, the shell-lobes almost entirely covering the shell. The centre of exposed shell is situated 0·7 inch from the head. There is a strongly marked line from the posterior shell-margin down the ridge of the foot, and seen best when this is extended.

The largest specimens seen were 3·9 and 4·2 inches long.

Hab. Moyong, N.W. Khasi Hills.

The radula (Plate LXII. fig. 1) has a greater number of teeth in a row than is seen in *Macrochlamys*.

95 . 2 . 18 . 1 . 18 . 2 . 95
115 . 1 . 115

The median teeth have a basal toothlet on the outer margin; the laterals are all biscuspid, the outermost being very small.

Jaw (Pl. LXII. fig. 1 *a*) with only a slight projection on the middle edge.

Generative organs of G. hookeri, var. shillongensis.—In every way similar to *Austenia gigas*, Bs. The ovo-testis consists of five separate bunches or lobes of very minute globular follicles, each lobe having a separate duct leading to the main hermaphrodite-duct: this gradually widens, and becomes much thickened, with several sharp convolutions; it then suddenly contracts again, leading to the junction of the albumen-gland. Here a short pear-shaped cæcum is conspicuous (only seen in one specimen).

The albumen-gland was not perfect, but appeared as if formed of two lobes (from above specimen).

The prostate was wide, ribbon-like; the oviduct with three or four great folds, which extend to the posterior termination of the spermatheca, which is not so long as to be infolded by it. The vas deferens is given off a very short distance below the end of spermatheca, high up the oviduct; and it extends backwards to near the base of the penis and amatory organ, in a loop, to join the former close behind a cæcum-like appendage rounded at the end (the cæcum calciferum). The penis is bent on itself, where a long process is given off, to which the retractor muscle is attached. The amatory organ (dart-sac) is a long cylindrical body, becoming finer towards the posterior end; its retractor muscle has its attachment with that of the penis, close below the apex of the shell, in the body-cavity.

The spermatheca is of the same size as the latter, and in this specimen presents a swollen sac below, terminating in a short, thin cylindrical point, which is buried amidst the convolutions of the oviduct. The form of spermatheca depends entirely on the number of spermatophores it contains.

The spermatophore is similar to that of *Austenia gigas*, but rather shorter, the sac being 0·3 inch long. The cervicorn processes at the base are strong and numerous, much branched above (P. Z. S. 1880, pl. xxvii. figs. 8, 8 *a*). The basal duct is 0·2 inch in length. Three of these were found in the spermatheca examined.

Girasia hookeri, var. brunnea, G.-A. (Plate LX. figs. 3, 4, from nature.)

Girasia hookeri, var. *brunnea*, Godwin-Austen, Journ. A. S. B. 1875, p. 5.

Helicarion (sec. A) *brunneus*, Theob. Supp. Cat. p. 23.

Parmarion brunneus, Nevill, Hand-list, p. 13.

Helicarion brunneus, Pfr. ed. Cles. Nomen. Helic. Vivent. p. 30.

Animal a rich brown, mottled on the mantle with dark sepia, *distinctly marked with parallel groovings*, that extend from the zigzag pallial line running along the side of foot, the margin of which is edged below with a series of short, dark, fringe-like markings; foot beneath dark ochre. Large portion of shell exposed, which is of same form as that of *G. hookeri*, var. *shillongense.*

Dimensions when fully extended:—

	inch.
Extremity of foot to posterior end of mantle ..	1·5
Mantle	1·6
Anterior end of mantle to head	0·47
Total......	3·57
Eye-tentacles	0·32
Breadth of body	0·56

Hab. Shillong, Khasi Hills, in grassy localities.

GIRASIA HOOKERI, var., G.-A. (Plate LX. fig. 5, from life.)

Girasia hookeri, var. *shillongensis*, Godwin-Austen, Journ. A. S. B. 1875, p. 4, pl. ii. figs. 1, 1 *a*; id. P. Z. S. 1880, p. 294.

Helicarion (sec. A) *shillongensis*, Pfr. ed. Clessin, Nomen. Helic. Vivent. p. 30.

Animal ochre-colour, the mantle being slightly paler than the rest of the body; there is no longitudinal grooving on the side of the foot, which, viewed under a lens, *is covered with minute protuberances evenly distributed*; foot beneath dull ochre-brown.

Shell horny, thin, long and narrow, pale green in colour.

Length 0″·9, diam. 0″·28.

The dimensions of these creatures are not so easily taken, the different parts expanding and contracting alternately.

	inch.
Extremity of foot to posterior end of the mantle ..	1·9
Mantle	1·5
Anterior end of mantle to head	0·9
Total	4·3
Eye-tentacles	0·42

Another (Plate LX. fig. 5, from life) animal dark umber-brown; body concolorous, the mantle a shade lighter, nearly covering the shell in both varieties; the foot beneath is ash-coloured; in this particular specimen there is a slight abnormal indentation at the anterior edge of the mantle.

	inch.
Extremity of foot to posterior edge of mantle......	1·70
Mantle	1·70
Anterior end of mantle to head	0·95
Total	4·35
Eye-tentacles	0·45

Hab. Shillong. Both these forms are merely local varieties of *hookeri*.

A specimen obtained, also at Shillong, in April 1875 was 4 inches long, of an olivaceous brown. An examination of some twenty

specimens from the Khasi Hills* shows that they vary very much in colour, from pale ochre to dark brown and even pale grey, while some are dappled, and others very much spotted on the mantle and sides (var. *maculosus*). I notice, too, that while some have the white raised rib near the periphery of the shell very well marked, in others it is absent, so that this is a most variable and unreliable character. It is apparently due, as is also the surface of the body, to the amount of atmospheric moisture at the time, and the size of the shell-lobes is greatly dependent on the same.

GIRASIA BURTII, G.-A. (Plate LXI. fig. 2, shell; and Plate LXII. figs. 3, 3 *a*.)

Helicarion (*Hoplites*) *burtii*, Godwin-Austen, Journ. A. S. B. 1876, p. 314, pl. viii. fig. 6.

Girasia burtii, Godwin-Austen, P. Z. S. 1880, p. 294.

Original description:—"Shell dull white, very horny in texture, the apex scarcely developed, outline rounded above. Major diam. 0″·30.

"Animal grey-brown in colour, the largest measuring as follows:—mantle to head 0″·40; mantle 0″·80, mantle to extremity of foot 0·50; or total length when moving 1″·5."

Hab. The Borelli Tea Garden, near Tezpur, Assam; discovered by Mr. J. Burt, after whom I name it, and who found it abundant on the bark of trees during the rains (July). It is of the true typical form of *Girasia*, but in its very rudimentary, white, horny shell it is quite distinct from any of the other species I am acquainted with. I have since, through the kindness of Mr. D. McT. Lumsden, received a number from Paniputer Tea Garden, in the same district, north of the Brahmaputra; they vary somewhat in colour, and a few are mottled. I am thus able to give some further details. The generative organs (Plate LXII. fig. 3 *b*) like type, the amatorial organ shorter and blunter. The jaw (Plate LXII. fig. 3 *a*) curved in front, no central projection. The central teeth are narrow and long, with the small cusp low down on the outer side; the 7th and 8th are transitional in form, with the point of the outer cusp nearer to the main point; from the 9th outwards all are of the simple, evenly bicuspid form, becoming gradually smaller. (Plate LXII. fig. 3.)

186 . 2 . 6 . 1 . 6 . 2 . 186
194 . 1 . 194

being many more than in *G. hookeri*.

GIRASIA RADHA, G.-A. (Plate LX. figs. 6, 6 *a*, living animal.)

Helicarion (*Hoplites*) *radha*, Godwin-Austen, Journ. A. S. B. 1876, p. 314, pl. viii. fig. 4.

Girasia radha, Godwin-Austen, P. Z. S. 1880, p. 294.

Original description:—"Shell similar to that of *H. shillongensis*.

* Since sent me by Mr. M. Ogle.

Animal rich ochre, sparsely dappled with grey-black on the mantle and tail.

"Length 3″·0, head to mantle 0″·50, mantle 1″·3, mantle to end of foot 1″·0, tentacles 0″·38.

"*Hab.* Banks of Radha Pokri (tank), near Narainpur, Darrang district, Assam; only one specimen was found, in the early morning."

It is a close ally of the Khasi-Hill forms *G. hookeri*, &c., but its very different coloration and markings distinguish it. The shell is more rudimentary than in that species, being extremely thin and membranaceous, and is only a local variety on this side of the Brahmaputra of *G. burtii*.

GIRASIA CROCEA, G.-A. (Plate LX. fig. 2, drawn from life by the author, and Plate LXII. fig. 6.)

Helicarion (*Hoplites*) *croceus*, Godwin-Austen, P. Z. S. 1872, p. 517, pl. xxx. figs. 9, 9*a*.

Helicarion croceus (sec. A), Theob. Supp. Cat. p. 23; Pfeiffer, ed. Cless. Nomen. Helic. Vivent. p. 30.

Parmarion croceus, Nevill, Hand-list, p. 13.

Original description:—"Shell very flat, rudimentary, oblong, thin, horny, transparent, pale yellow-green, with a longitudinal band of dark green, most intense on the outer margin, extending from near the pale-coloured apex to the edge of the peristome; spire very short, apex flatly curved; peristome membranous, very thin, transparent; within the single body-whorl the colour is pale milky with some blue reflections.

"Diam. major 0·75, minor 0·35 inch.

"Animal is of a fine bright saffron-yellow colour; when contracted it has a richer gamboge tint; mantle mottled with pale yellow; a narrow edging of yellow extends round that portion of the mantle covering the shell; another narrow band extends from the posterior left side of the mantle towards the anterior left side, fining out and terminating about $\frac{3}{8}$ inch from the edge. From the posterior right side a short line of yellow extends as far as the respiratory orifice; outside edge of foot very pale yellow, and almost white below; extremity of foot truncate, with a gland as in *H. gigas*. Length of animal $2\frac{1}{2}$ to 3 inches; tentacles pale yellow, 0·45.

"This very handsome species is very abundant during the height of the rains in the valleys below Cherra Poonjee; and in the living animal the small portion of shell not hidden by the mantle-lobes is of a jet-black colour." I first found it crawling over the tall grasses high above the ground, by the side of the road a few hundred feet above Teria Ghat. In the odontophore (Plate LXII. fig. 6) of this species we find considerable modification when compared with the type species, and there is a distinct approach to what is seen in *Durgella khasiaca*, viz., an even bicuspid central tooth. The first 9 median teeth are indistinctly bicuspid, while all the outer are evenly biscuspid. The whole series decreases gradually in size to

the outermost laterals, and the teeth are numerous, arranged thus:—

100 . 9 . 1 . 9 . 100
110 . 1 . 110

GIRASIA NAGAENSIS, G.-A. (Plate LXI. figs. 3, 3 *a*, 3 *b*, 3 *c*.)

Helicarion nagaense, Godwin-Austen, Journ. A. S. B. 1875, p. 5, pl. ii. figs. 3, 3 *a*, 3 *b*, 3 *c*.

Girasia nagaensis, Godwin-Austen, P. Z. S. 1880, p. 294.

Helicarion (sec. A) *nagaensis*, Pfeiffer, ed. Cless. Nomen. Helic. Vivent. p. 30.

Original description:—"Animal ochre-colour, prettily mottled and dotted with a darker shade of the same; the mantle covers nearly the whole shell; a narrow white line, commencing near the posterior margin of the slit disclosing the shell, extends round towards the respiratory orifice on the right-hand side, and in front another line curves round to the left anterior side. Mucous gland as in *H. gigas*. Length about 3 inches. Shell ovate, exceedingly thin and brittle.

"Major diam. 0·90, minor diam. 0·55 inch."

GIRASIA DALHOUSIÆ, n. sp. (Plate LXI. figs. 1, 1 *a*, and Plate LXII. figs. 4, 4 *a*.)

The Station of Dalhousie, Chamba Hills (*W. Theobald*).

The animal in spirit is of a very pale ochre tint, with no markings of any kind. The mantle as in typical *Girasia*, the thin shell showing in an oval opening of the shell-lobes.

The shell is of an olive-brown colour, convex above, oval on the periphery, membranaceous, broader than in the type, or in *G. crocea*, with a very thin, white, shelly lining.

Major diam. 13·0, minor 8·0 mm.

Length of animal in spirit 0·30 mm.

The radula is arranged thus (Plate LXII. fig. 4):—

128 . 2 . 14 . 1 . 14 . 2 . 128
144 . 1 . 144

It differs somewhat from the eastern species; the central tooth is very long, narrow, and tricuspid; the median teeth are much curved, the points directed somewhat outwards, they are tricuspid, but not sharply so, the inner cusp being indistinct; the laterals are bicuspid, the outer cusp being larger and rounder in form than the inner.

Jaw straight in front, with only a very slight central projection (Plate LXII. fig. 4 *a*).

This is the first species of the genus *Girasia* I have seen from the N.W. Himalaya, and it is therefore of interest as regards distribution: there was only a single specimen in the bottle sent me by Mr. Theobold, so that it will be important to find it again in the same locality; the species associated with it (*i. e.* in same bottle) were all N.W.-Himalayan forms.

GIRASIA PANKABARIENSIS, n. sp. (Plate LIX. figs. 1, 1 *a*, 1 *b*, animal.)

Pankabari, foot of Darjiling Hills (coll. *F. Stoliczka*).

Animal with the right and left mantle-lobes united, the line of junction well seen, as in the Khasi-Hill typical form; the mantle appears to be slightly speckled. The shell is deeply sunk in a depression, the ridge of the foot behind being on a level with the shell. It is the first true *Girasia* I have seen from the Darjiling country.

Shell has been removed and is in the Calcutta Museum.

Generative organs immature.

Odontophore: + 100 . 2 . 16 . 1 . 16 . 2 . 100 +
118 . 1 . 118

Teeth gradually decreasing in size from centre to margin.

Jaw straight, with a very slight central projection.

GIRASIA CINEREA, G.-A.

Girasia cinereus, G.-A., J. A. S. B. 1876, p. 314, plate viii. fig. 2.

The shell was not described when taken, and it has since been mislaid. The description of the animal, which is of more importance, is as follows:—

Original description:—" Animal, when fully extended, long and narrow, colour dusky grey, mantle with a papillate surface slightly spotted, the spotting being coarser on the body and tail. Tentacles short and blunt, with the oral ones very close below them.

" Length 0″·75, mantle 0″·40.

" *Hab.* On the Darpang river, foot of the Dafla Hills, under old logs in the forest."

GIRASIA MAGNIFICA, Nev. & G.-A. (Plate LVI. figs. 1, 2, 3, 4, animal; 5, 5 *a*, shell.)

Helicarion magnificus, Nevill, Journ. A. S. B. 1877, p. 24.

Helicarion (Austenia) magnificus, Nevill, J. A. S. B. 1881, p. 129, pl. v. figs. 23, 23 *a* (shell).

Girasia magnifica, Godw.-Aust. P. Z. S. 1880, p. 294, pl. xxiv. figs. 1 and 2 (animal).

Helicarion (Austenia) magnificus, Nevill, Hand-list, p. 16.

Nevill's paper, " List of the Mollusca brought back by Dr. J. Anderson from Yunnan and Upper Burmah," contains the

Original description:—" I am indebted to Major Godwin-Austen for pointing out that this magnificent slug, the largest yet known of the genus, is quite distinct from Benson's *Helic. gigas* (Khasi Hills); Godwin-Austen has kindly undertaken to describe the animal with full details and a figure, so that it is only necessary for me here to state that it is very closely allied to the Assam species, but that the shell is much larger, of a brown (not green) colour, with the body-whorl much more flatly expanded, and the spire less convoluted and more

depressed, and that, looked at from underneath, very much less of the reflected body-whorl is visible. The largest specimen in spirit measures 70 mills.

"Shell, diam. maj. 46, axis $11\frac{1}{2}$, apert. lat. $40\frac{1}{2}$, alt. $29\frac{1}{2}$ mil.

"Tolerably abundant at Momein, in Yunnan, at 5500 ft."

Teng-Yue-Chow is the locality given by Nevill in his Hand-list.

This giant of the genus was first figured by me in the P. Z. S. 1880, from a drawing I had made when in Calcutta of a specimen in the Museum there, but at the time I subsequently described the genus *Girasia* I had no specimen of it by me to examine. I afterwards received one from Mr. Geoffrey Nevill, and this I have figured again in this work. As will be seen by the uniting of the shell-lobes the shell is almost completely covered by the mantle, the cicatrix marking the junction of the right and left being well displayed. The extremity of the foot behind is sharply keeled, and ends abruptly just behind the shell, which is sunk in a depression, as it were, anterior to the keeled foot. The mucous pore is a long vertical slit behind. In the odontophore the centrals are of the usual form in this group, but the laterals are long, curved, and pointed, the outer cusp being situated very much below the apex. In this respect it is like the labial ribbon of a species described by me as *G. gigas* var. *minor* of the Burrail Range, Naga Hills (J. A. S. B. vol. xliv. 1875, p. 10, plate iii.), a species which I have renamed *butleri*, as it is a *Girasia*, not an *Austenia*.

The generative organs of *G. magnifica* are as in the type; the amatorial and male organs are only smaller in comparison to the size. Spermatophores were present in the spermatheca and were about 35 mm. in length, in every respect similar to those figured by me in the P. Z. S. 1880, fig. 4, pl. xxvi., with some modification in the number and form of the cervicorn processes, as represented in fig. 5.

GIRASIA BUTLERI, G.-A. (Plate LX. fig. 7.)

Helicarion gigas, small var., Journ. A. S. B. vol. xliv. 1875, p. 6, plate iii. (animal, nat. size).

Austenia gigas, var. *minor*, Godw.-Aust. P. Z. S. 1880, p. 294, plate xxv. figs. 1, 5, plate xxvii. figs. 9 and 10.

? *Helicarion* (*Austenia*) *resplendens*, Nevill, Hand-list, p. 16.

This species is thus described in my note-book :—"Animal dark ochre-brown, with very dark marking, particularly noticeable along the margin of the foot."

Hab. Between Samaguting and Kohima, Naga Hills.

Shell: major diam.	21·5 mm.,	minor diam.	18 mm.
,,	0·84 inch	,,	0·55 inch.

Of the same form as *A. gigas*, but with a fine glassy lustre and olivaceous brown. I have now only the shell in my possession, and it would be very desirable to obtain more specimens from this locality and examine them more closely. In its shell-lobes it is

very like *A. gigas*, from Teria Ghat, but the hinder part of the foot is more like that of *Girasia hookeri*.

In size the shell is that of *Helicarion resplendeus*, described by Nevill, J. A. S. B., from specimens collected by Dr. J. Anderson at Sawady, on his journey to Yunnan; but I have never examined the original specimens; it is possible they are one and the same species.

GIRASIA PEGUENSIS, Theob. (Plate LIX. figs. 6, 6 *a*, 6 *b*, animal; 6 *c*, 6 *d*, shell.)

Girasia peguensis, Theob. Journ. A. S. B. 1864, p. 244.
Vitrina peguensis, Hanley, Conch. Ind. p. 29, pl. lxv. figs. 2, 3.
Helicarion (sec. B) *peguensis*, Theob. Supp. Cat. p. 23.
Girasia? peguensis, Godw.-Aust. P. Z. S. 1880, p. 294.
Helicarion (*Austenia*) *peguensis*, Nevill, Hand-list, p. 16.

Original description:—"*Animale pallide lutescente anteriori parte virescente; posteriori tamen luteo-flavescente. Tentaculis superioribus longis et cum cervice virescentibus; inferioribus parvulis; pallio granulato, cutis anserinæ modo; fusco, testam omnino fere obtegente. Caudali papilla nulla. Longitudina* 80 *mills.*

"*Testa elongata, halicoidea, polita, subdiaphana; margine tenui, virescente; reliqua parte flavescente, et juxta apicem solidissimum albescente.* Long. 15, lat. 9, alt. 4 mills.

"Habitat in humidis locis prope Pegu. This species belongs to the same section as *V. gigas*, B., which it resembles in miniature, and is remarkable for its solid columella and apex."

Description from spirit-specimen (length 50 mm.):—The posterior part of the shell rests in a depression of the hinder part of the foot, though it is not so distinctly of V-shape, or so deep as in *Girasia hookeri*. The colour is a ruddy brown, the mantle somewhat greyer and a good deal mottled; the sides of the foot are speckled with dark grey. Individuals of all these species, as may be noted, differ very much in coloration, and in this species quite unspotted specimens no doubt occur. There is a very distinct, pale, ridge-like line or bar extending from near the respiratory orifice backwards, and following the edge of the right shell-lobe; another similar bar runs along the left margin of the left shell-lobe. The mantle and its lobes are exactly as in *Austenia gigas*, and it thus forms a very perfect link between the two subgenera *Girasia* and *Austenia**. The shell has the apex more developed than in *Ibycus* and is like that of *Austenia*.

The long retractor muscle of the left eye-tentacle and the buccal mass are joined together and have their attachment posterior to the shell and body-cavity; and this is different from *A. gigas*, where the same muscles have their attachment on the frontal margin of the body-cavity. The right eye-tentacle is separate, its attachment is on the posterior margin of the body-cavity, and the penis retractor muscle attachment is also here but posterior to it. The generative

* I place it in the first at the end of the series.

organs are immature in all the specimens I received from Mr. Theobald, but enough to show that they are like *Girasia*. Jaw and radula as in *A. gigas*.

32 . 3 . 18 . 1 . 18 . 3 . 32
53 . 1 . 53

GIRASIA ? RUBRA, G.-A. (Plate LXI. figs. 4, 4 *a*, 4 *b*, 4 *c*, 4 *d*.)

Parmarion ? *rubrum*, Godwin-Austen, Journ. A. S. B. 1875, p. 6, pl. ii. figs. 4, 4 *a*, 4 *b*, 4 *c*, 4 *d*.

Original description:—"Animal of a fine orange-pink, grey on underside of the foot; tentacles short, mantle entirely covering the shell, with only a slight trace of a longitudinal opening running back from the anterior left side, three parallel bands of greenish grey along the back of the neck, the eye-tentacles being of the same colour. The gland at the extremity of the foot with a long, overhanging lobe.

	inch.
"Extremity of foot to posterior end of mantle	0·9
Mantle	0·8
Anterior edge of mantle to head	0·4
Total length when moving	1·8

"Shell quite rudimentary, minute, granular: major diam. 0·14 inch.

"*Habitat*. Kohima, Naga Hills, in brushwood.

"The mucous gland in this species differs considerably from that of *H. gigas* and its allies, the upper lobe projecting and hanging over so as to present, when viewed sideways, a narrow slit."

The exceedingly small rudimental shell, so completely enveloped by the mantle, almost entitles this form to subgeneric rank; but as only one specimen has been obtained, and was not fully examined as to its internal anatomy, I place it for the present at the end of the series of *Girasia*.

Subgenus AUSTENIA (*continued*: *vide* p. 148, Part IV.).

All with smooth or polished shells.

AUSTENIA GIGAS, Benson. (Plate LV. figs. 3, 3 *a*, 3 *b*, animal from spirit-specimen; Plate LX. figs. 1 and 1 *a*, from living animal; Plate LXII. fig. 8, radula.) Type of the genus.

Vitrina gigas, Benson, J. A. S. B. 1836, p. 350.

Austenia gigas, Godw.-Aust. P. Z. S. 1880, pp. 294–298, pls. xxiv., xxv., xxvi.

Helicarion gigas, Godw.-Aust. J. A. S. B. 1875, pl. iii.; Pfr. Mon. Hel. vol. ii. p. 496.

Vitrina gigas, Reeve, Conch. Icon. fig. 13; Hanley, Conch. Ind. p. 29, pl. lxvi. figs. 2 & 3.

Helicarion (sec. B) *gigas*, Theob. Supp. Cat. p. 23.

Austenia gigas, Nevill, Hand-list, p. 16.

Helicarion (sec. B) *gigas*, Pfeiffer, ed. Clessin's Nomen. Helic. Vivent. p. 30.

Locality. Teria Ghát, Khasi Hills.

Shell ovate, broad, depressed; body-whorl large and expanded, with a shining lustre, quite smooth, excepting the irregular lines of growth; colour olivaceous, with sienna-brown, paler at the apex, somewhat nacreous within (one specimen is entirely sienna-brown, and milky white within); apex flat; whorls about $1\frac{1}{2}$; columellar margin very short and very oblique.

Largest specimen: maj. diam. 1·7, min. 1·2 inch (=42·5 and 30 mm.).

Another: maj. diam. 38·3, min. 24·5 mm.
„ 1·53, „ 0·95 inch.

"*Animal.*—The left dorsal lobe * (*l.d.l.* plate xxiv. figs. 3, 4, 5) is large in front, and extends from the respiratory orifice to the left margin. The right dorsal lobe (*r.d.l.*) extends from the same part to the posterior right margin. The shell-lobes are connected all round the periphery of the mantle-zone, but are reduced in size, and present two distinct right and left contractile lobes; the right extends to and covers the apex of the shell, while the left extends over the edge of the body-whorl for a distance of 0·3 to 0·5 inch, leaving the posterior and the greater portion of the upper surface of the shell uncovered (we have here a true approach to what is seen in the subgenus *Macrochlamys*). The posterior margin of the shell is not sunk in a depression of the hinder part of the foot, but the upper surface of the foot extends in an unbroken ridge to the mantle-zone."

In Plate LV. figs. 3 and 3 *a*, the animal is shown with the shell removed; fig. 3 *b* gives the position of the shell-lobes viewed from behind; the apex of the shell and all it contains sliced off.

"Extremity of the foot truncate, with a large linear mucous gland, the pedal line very distinct, as well as the lateral markings on the surface of the body.

"Genital aperture at the lower and outer base of the right tentacle.

"Animal reaches quite 4 inches in length.

"*Description of Genital Organs of* A. gigas.—Small var., Khasi Hills (plate xxv. fig. 1).—The ovo-testis was not seen; the hermaphrodite duct (*h.d.*) is much convoluted at the anterior end, where it divides; the shape of the albumen-gland was also unobserved, and had apparently not been preserved in the spirit. The oviduct (*ov.*) was very closely convolute, and arranged in four sharp folds upon the posterior portion of the spermatheca (*sp.*), to which it is apparently held by muscular tissue. The prostate is wide, regular, and ribbon-like, much and closely convolute, giving off the vas deferens not far above the junction of the spermatheca with the oviduct; this

* Refers to paper and plates in P. Z. S. 1880, pp. 289–299.

is very long, extending forward between the inverted eye-tentacles, forming a loop among the muscles of the buccal mass.

"The penis is bent on itself at the point where the retractor muscle is given off (*Pe.* fig. 4): and a short, blunt, rounded portion extends beyond the insertion of the vas deferens (*pd.*) corresponding to the flagellum in some species, or the Kalksack of Semper (the cæcum calciferum vasis deferentis).

"The retractor muscle of the penis has its attachment, together with the eye-tentacles, in the usual position, close below the apex of the shell, near the posterior margin of the body-cavity (plate xxiv. fig. 3 *m*)."

Detailed Anatomy of Penis of A. gigas (plate xxvi. figs. 2, 3).—"On the removal of the outer muscular sheath, the anterior end is of a hollow cone-shape (*a*), which, on being cut away, presented within a cup-shaped depression (*a'*), and exposed the duct of the penis. It contracts suddenly, and continues as a smooth stout tube of equal size for about 0·25 inch, where it expands again (*b*) into a stouter portion of cylindrical form, which is 0·55 inch long, and continues, with gradually lessening thickness, up to the part where it is turned suddenly backwards, and close to where the retractor muscle is given off (*c*). On removing the outer layer a chitinous sheath was exposed lying against the thin membrane beneath (*b' b*); and following this down, it was found to be the basal end of the spermatophore, with the peculiar cervicorn processes at the base, *in situ* where developed. On opening the membranous sac, it was found to consist of one continuous thread coiled down on itself (fig. 3), and pressed closely together, and was in such good preservation as to be easily unravelled. I drew out and measured a portion $\frac{1}{10}$ inch in length, and found it to contain 15·1 inches; the whole length of this part being 0·55 inch in length, would give nearly 7 feet for the total contents of the sac. It is, in fact, a spermatic thread of hardened spermatozoa, poured out from the vas deferens *.

"On further examining the part near *c*, this cylindrical portion was found to end in a conical cap, which again gave off a thin rod, which bending sharply back, is evidently in communication with the extension of the vas deferens towards *d*. Behind the junction of this last is a short gland rounded at the end (*e*), which contained some very microscopic transparent crystalline bodies of oval form (fig. 2 *a*). This is the Kalksack mentioned above, and secretes the material for the formation of the spermatophore.

"This spermatophore, which is an organ of a very complicated and curious form, may be thus described:—The basal or anterior end consists of a chitinous strap about 0·4 inch long, with the sides more or less turned over, forming a sort of trough or long spout, which, after it has passed into the spermatheca of the other individual, will be found opening into the lower part of the oviduct. At the other end the sides at last meet and form a tube; it then thickens and

* "This thread is similarly described by M. Baudelot, Ann. Sci. Nat. 1863, p. 165, in his description of the capriolus of *Arion rufus*."

widens, giving off several strong cervicorn or more or less branched processes, which are directed backwards: they serve, I think, to aid in the expulsion of the spermatophore from the penis, and, when once within the spermatheca or vagina, serve as holding-hooks to prevent its withdrawal. The part above this consists of a very long thin membranous bag 0·4 inch long, terminating in a hard conical cap, from which proceeds a thin rod, which is found to extend to the hard rounded apex of the spermatic sac, where it bends over or ends in a few separate filaments within the tube of the vas deferens. In one specimen of this species (*gigas*) no less than seven perfect spermatophores were counted, closely packed together side by side within the spermatheca. (Van Beneden observed two in a *Parmacella*, Ann. Sci. Nat. 1857, p. 371.)

"It would appear that in these creatures even one act of copulation would fertilize for a very considerable period; for it would be some time before the contents of a spermatophore became exhausted.

"This organ, as situated in the penis, presents the character of a perfect spring (*vide* plate xxvi. figs. 2, 3); and it can be imagined that when it enters the wider and very elastic sac of the spermatheca, and is then gradually released, it will tend to become quite straight, and that, the recurved processes holding it at one point, the longer portion will bend round to the long axis of the sac, bringing the end of the shorter portion (plate xxvi. fig. 3 *a*) to the aperture within the vagina and ovo-testis (plate xxvi. fig. 4, *j. sp.*).

"*Macrochlamys decussata*, of which I have a drawing, taken when the animals were *in coitu*, protruded a large white bladder-like sac, which expanded and contracted from time to time as if inflated with air; this I now think may have been the spermatheca drawn out and receiving the penis and capreolus.

"In the two specimens I examined, the spermatheca (*sp.*) was elongate, smooth, lying close to and partly enveloped by the convolutions of the oviduct &c., with its posterior end near the junction of the hermaphrodite-duct and albumen-gland. This posterior termination is bent over on itself, presenting a smooth rounded end (plate xxv. figs. 2 & 4), which coiling round, terminated, and was covered with what was apparently muscular tissue buried in the prostate and oviduct. The form of the spermatheca is due to its contents; and the rounded end is produced by the bending-over of the flagellum-like terminations of the enclosed spermatophores.

"In one specimen of *G. hookeri* which I examined, probably taken in the cold weather, all the generative organs are small and contracted, the spermatheca only represented by an attenuate sac.

"The amatorial organ or dart-sac (D)* is a long cylindrical body narrowing towards the genital aperture, and again swelling there into a large orifice: it has a very thick and muscular structure, and in these spirit-specimens is very hard and unyielding. When cut open longitudinally, the dart or *spiculum amoris* was found to be a simple cylindrical rod, sharply pointed (plate xxvi. fig. 7). This

* "Glandula mucosa cum sagittâ amatoriâ."

organ has a strong retractor muscle, with its attachment near that of the penis."

Relative Position of the different Parts in A. gigas.—"On cutting through the skin of the upperside of the back, commencing from between the eye-tentacles, the penis is seen lying in the middle line between the inverted eye-tentacles (plate xxv. fig. 2); on the proper left of it are seen three large convolutions of the intestine (*i*); and on laying it over to the right side the salivary glands of flattened form are seen spreading over these, and a distinct connexion with the central convolution was very clearly made out (fig. 5, *a*). Proceeding from the sides of the buccal mass will be noticed two strong muscles, which have their attachment on the frontal margin of the body-cavity, at the point (plate xxiv. fig. 3) *m*; these are the retractor muscles of the head and buccal mass.

"The spermatheca lies on the right side of the animal, covered partly by the oviduct; and a large expansion of the intestine occupies the posterior portion of the cavity, narrowing suddenly to enter that of the shell above.

"A very large mucous gland lies next the sole of the foot along the whole length of the body-cavity: and two large pedal nerves are conspicuous and traverse it, throwing off nerves to the epidermis, and extend on to the caudal gland."

The teeth of the radula (Plate LXII. fig. 8) are numerous, arranged thus:—

$$\frac{69 \;.\; 3 \;.\; 22 \;.\; 1 \;.\; 22 \;.\; 3 \;.\; 69}{94 \;.\; 1 \;.\; 94}$$

presenting a large number of broad central teeth, the central bluntly bicuspid, the first 6 central on either side show only a blunt cusp on the outer base, but from the 7th to the 25th an inner notch becomes apparent. The inner laterals are long, curved, pointed teeth, with a cusp low down on the outer margin; this disappears about the 50th, and thence to the edge of the radula they are simple unicuspid teeth, becoming gradually shorter in length. It is thus very distinct from the odontophore of any species of *Girasia*. The jaw (Plate LXII. fig. 8 *a*) is much curved anteriorly, and has a well-marked notch on the middle edge.

Austenia scutella, Bs. (Plate LII. figs. 1–1 *e*.)

Locality. Nasmana, in the Chinab valley, on the direct road from the Panjal to Sealkote (from W. Theobald's collection).

Vitrina scutella, Bs. A. & M. N. Hist. 1859, vol. iii. p. 188; Pfr. Mon. Hel. vol. iv. p. 798; Reeve, *Vitrina*, f. 13; Hanley, Conch. Ind. p. 29, pl. lxvi. f. 4 (it is not known whether this figure represents the Khasi or Kashmir specimen; from its size *it must be the latter* (vide original descr.). Hanley considers this the variety, but on what grounds it is not clear).

Helicarion (sec. B) *scutella*, Theob. Supp. Cat. p. 23.

Helicarion scutella, Nevill, Hand-list, p. 15 (8 specimens, Assam, Stol.: these certainly must belong to another species: though

collected by Stoliczka they were not determined by him); Theob. J. A. S. B. 1878, p. 143.

Original description :—" *Testa valde depressa, peripheria oblongo-ovata, arcuatim striatula, nitente, translucente, pallide viridi-lutescente ; spira valde planata, apice prominulo, sutura impressa, marginata ; anfractibus* 3½ *rapide accrescentibus, ultimo antice latissimo, superne antrorsum arcuato, horizontaliter compresso, non descendente, peripheria valde rotundata ; apertura valde obliqua, ovato-lunari ; peristomate simplici, marginibus conniventibus, columellari oblique descendente, basali leviter arcuato.*

" Diam. major 18, minor 13, axis 6 mill. " " 16, " 11, " 5 "	Kashmir.
" Apert. lat. 12, alt. 7 mill. " " 11, " 6 "	Teria Ghát.

" Habitat ad Teria Ghát, montium Khasiæ ; necnon ad Nasmana, regionis Kashmir.

" Of this species *the larger* example from Kashmir was first sent by Mr. Theobald, and subsequently another specimen, obtained by him at Teria Ghát, was received. The non-occurrence of the form in the intermediate mountains of Sirmore, Kemaon, and Sikkim, where other species take its place, is worthy of note. It is remarkable for its depressed form and lengthened aperture, which at once distinguish it from its ally, *V. monticola*, occupying the mountain region between the rivers Sutlej and Gagra. The Khasia specimen has a few remote spiral depressions on the last whorl near the suture; they are probably accidental."

It is evident that Mr. Benson had before him two distinct species. The shells of this genus are so very similar they may easily be confounded. I have now received several spirit-specimens of undoubted *A. scutella* from Mr. Theobald, collected by him in the N.W. Himalaya, at Murree and Dalhousie, taken out of bottles with other undoubted species from the above localities, and referred to on (*l. c.*) p. 143. I can state there is no form at all approaching it at Teria Ghát, in the Khasi Hills, nor have I seen anything like it either from Darjiling or Assam.

Mr. Benson's largest specimen (and it agrees in size with the shell I figure) is true *scutella*, the one he first obtained from Mr. Theobald; the other remains to be determined, and I think I have the species in my collection. The shell figured (Plate LII. figs. 1 *c*, 1 *d*, and 1 *e*) is from Mr. Theobald's collection, from typical locality Nasmana, Chinab valley, on direct road from Islamabad over the Pir Panjal mountains to Sealkote.

The chief interest attached to this species is its close resemblance on the one side to *Macrochlamys*, and on the other to the *Helicarion*-like group ; it thus forms a link between them through *M. flemingi* and species like *A. gigas*, and we have presented to us an excellent example of the gradual growth of shell-lobes, completely altering and modifying the form of the animal and shell.

Description of the Animal (Plate LII. fig. 1 *a*). The shell does not

rest in a depression in the foot, the ridge of the foot runs directly away from the mantle-zone to the mucous pore. The right dorsal lobe is well developed; the left dorsal lobe extends in one continuous flap round to the left posterior margin, where it ends abruptly. The right shell-lobe is very large, broad and triangular, covering and playing over a large area of the shell on the right margin of the periphery, but not enclosing it in any way. The left shell-lobe commences from near the respiratory orifice and overlaps the edge of the peristome; it gradually widens, and finally becomes broad and tongue-shaped (fig. 1 *a*), corresponding to the narrow left shell-lobe seen in *M. petrosa* (*vide* Plate XIX. fig. 1) and to the still more similar reduced shell-lobe of *M. decussata* (fig. 6 of the same plate). The posterior portion of the foot is very long and sharply keeled. The pedal margin of the foot wide, with the pedal line strongly marked and segmented.

Generative Organs. Are very similar to those of *Macrochlamys* (*vide* Plate XVII. fig. 6). The amatorial organ is present, and is large and swollen at the basal end: the kale-sac is longer than in most species.

Spermatophore. Is long and sac-like (10·5 mm. in length), but the chitinous portion at the base has several recurved strong bifid spines, those above are straight and minute.

Odontophore:—

$$\begin{array}{c} 30 \;.\; 2 \;.\; 14 \;.\; 1 \;.\; 14 \;.\; 2 \;.\; 30 \\ 46 \;.\; 1 \;.\; 46 \end{array}$$

Of usual form, the outermost teeth of moderate size, bicuspid.

Jaw. Has a strong central projection.

Description of specimen figured:—Shell depressed, ovately oblong, umbilicated; sculpture quite smooth, covered with a thin epidermis, crossed by faint lines of growth; colour pale olivaceous ochre; spire very flat; apex subpapillate; suture shallow; whorls $4\frac{1}{2}$, rapidly increasing; aperture elongately oval; columellar margin vertical, becoming suddenly very oblique.

Size: major diam. 17·5, min. 13·0; alt. axis 5·5, body-whorl 8·5 mm.

Austenia? monticola, Benson, MSS. (*in coll. H. Cuming*). (Plate LII. fig. 2, 2 *a*.)

Vitrina monticola, Pfr. P. Z. S. 1848, p. 107; Bs. MSS., Pfr. Mon. Hel. vol. ii. p. 497; Reeve, Conch. Icon. fig. 11; Hanley, Conch. Ind. p. 61, pl. clii. figs. 1, 4 (is *H. stoliczkanus*, Nevill).

Vitrina (sec. *Phenacolimax*) *monticola*, Pfr. Nomen. Helic. Vivent. 1881, p. 27.

Helicarion (sec. B) *monticola*, Theob. Supp. Cat. p. 23.

Helicarion monticola, Pfr. Nevill, Hand-list, p. 15.

Locality. Mussoorie (*coll. G.-A.*) *.

* These specimens were shown to Captain Hutton, and named by him as above; and there can be no doubt this is the species known to him and Benson under this title.

The animal was thus described by me in my note-book of 1863 when at Mussoorie, where it is abundant during the rains, in suitable places :—

Animal long, too large for complete retraction into shell, which is further from the head than tail; mantle reflected over the margin of the shell. It would appear to be very similar to *A. scutella*, but I have not yet obtained the species in spirit from the original locality, and I am therefore not certain to what extent it differs.

Original description by Pfeiffer :—" Vitrina. *Testa depressa, tenui, striatula, nitida, pellucida, lutescenti-cornea; spira plana, medio vix prominula; sutura leviter impressa; anfractibus* 4, *celeriter accrescentibus; planiusculis, ultimo depresso, non descendente; apertura obliqua, rotundato-lunari; peristomate simplice, marginibus conniventibus, callo tenuissimo junctis, supero antrorsum, arcuato-dilatato, columellari cum basali angulum obtusum formante.*

" Diam. 18, alt. $7\frac{1}{2}$ mill.

" From Bengal, Landour, Himalaya, Almorah."

The shells from the Hill Station of Mussoorie, and Landour at its eastern end, are olivaceous, with spire more or less depressedly conoid; suture shallow; whorls 5; aperture ovate; columellar margin oblique.

Largest specimen: major diam. 27·0, min. 21·0, alt. axis 10·0, body-whorl 14·0 mm.

The four localities given above by Pfeiffer in sequence might puzzle some people not well versed in Indian geography. The two definite localities, Landour and Almorah, leave the exact habitat of the typical shell in doubt, and they are 100 miles apart. Almorah shells of this group that I have do not compare with those from Mussoorie.

Considerable confusion exists with regard to *monticola*, *cassida*, and *scutella*, and the localities in which they were originally collected. I think I may be able to clear this up, to a certain extent, having had the advantage of naming and comparing shells now in my collection, at the time they were collected by me at Mussoorie, with those in Captain Hutton's collection, and that officer well knew the shells he and Benson had described together. There can be no doubt that the large *Helicarion*-like snail of Mussoorie and Landour is *monticola*.

It therefore does not much signify what shell Pfeiffer described out of the Cuming collection, for it is impossible now to discover the identical type shell in the British Museum, for there are several specimens placed together under this title *monticola*. Nor do we arrive at any clear decision on comparing the figures of Hanley and Reeve; the first is taken from a shell in the Benson collection, and this cannot be traced, because the shells that have been figured are not marked, and Mr. Hanley sometimes selected shells for figuring from Benson's collection, sometimes from his own, from specimens sent home to him from India by Mr. Theobald from localities other than the original. These very similar shell forms from Burmah, Assam, and the N.W. Himalayas have got thus very much muddled up.

AUSTENIA THEOBALDI, n. sp. (Plate LII. figs. 5, 5 *a*, 5 *b*.)

Helicarion flemingi, var. *b*, Journ. A. S. B. 1871, p. 143; Nevill, Hand-list, p. 15. (All these shells with exception of the Naini-Tal specimen, which is the type of *stoliczkanus*, I refer to this species.)

Locality. Bichlari, Chinab valley (*Theobald*).

Theobald did not distinguish this form from *M. flemingi*, and under var. *b* of that species described it briefly as follows:—

"This race runs considerably smaller than the last, the largest specimen of some hundreds measuring 22 × 17 × 12 mm. It is a miniature of the last, and occurs abundantly in the Chináb valley, above the junction of the Bichlári River, and also at Dharmsala in the Kangra valley. The shell is almost wholly enveloped by the mantle when the animal is in motion."

AUSTENIA THEOBALDI (? STOLICZKANUS).

Locality. Chináb valley, above Bichlari River.

Shell globose, imperforate; sculpture none, surface polished and glassy: colour olivaceous or pale yellowish green; spire subconoid; suture well marked; whorls 4, tumid, convex, the last ample; aperture nearly circular; columellar margin thin, horny.

Size: major diam. 19·5, minor diam. 16·0, alt. axis 8·0, alt. body-whorl 12·0.

Five specimens were sent to me by Mr. Theobald, from the typical locality Bichlari. The description of the animal shows that it has no relationship to *flemingi* and it allies. It is distinct from *A. monticola* from Mussoorie, with which I have compared it, being much more globose, and the whorls more convex, and its colour is of a yellowish tint, the spire less closely wound.

Mr. Theobald sends three other specimens from the Chináb valley, the exact locality not given, which differ from the type in being much more polished and of a darker richer olivaceous tint, and are somewhat more depressed. This may be the shell of an animal with more distinctly marked differences, or may be due to some local condition.

I have another species received from F. Stoliczka, and referred by him to *monticola* with doubt; this I think is

AUSTENIA STOLICZKANUS, Nevill. (Plate LII. fig. 3, 3 *a*, 3 *b*.)

? *Vitrina*, sp., from Almorah, Hutton & Benson, Journ. A. S. B. vol. vii. p. 214.

Austenia stoliczkanus, Nevill, Second Yarkand Mission, Moll. p. 15.

? *Vitrina monticola*, Hanley, Conch. Ind. p. 61, pl. clii. figs. 1 & 4; Nevill, Hand-list, p. 15.

The three species from the Kashmir side are, I suspect, *A. theobaldi*.

Locality. Aertoolé, near Almorah, beyond Hawul Bagh.

This species is rather more tumid than *A. monticola*, and its tints of a yellower olive; it assimilates somewhat to the form of *H. theobaldi*, but is not so globose.

Size: maj. diam. 21·0, min. 16·0, alt. axis 7·0 mm.

A precisely similar shell I note in Mr. Theobald's collection from Sat Tal, near Naini Tal.

Size: maj. diam. 18·5, min. 14·5, alt. axis 8·0 mm.

AUSTENIA ? SERAHANENSIS, G.-A. (Plate LII. figs. 4, 4 *a*, 4 *b*.)

Locality. Serahan, Sutlej valley (*Stoliczka*).

Shell depressedly ovate, strong, not transparent, quite smooth, with a thick epidermis; colour deep ochre; spire and apex flat; suture shallow; whorls 3½, rapidly increasing; aperture narrowly ovate; peristome very sinuate above: columellar margin oblique.

Size: maj. diam. 11·5, min. 8·5, alt. axis 4·0, body-whorl 5·75 mm.

This shell was given me by Stoliczka without a name; it may be the same as the ten shells placed in *H. monticola* by Nevill in his Hand-list, p. 15. I have compared it with the young, very glassy shells of *monticola* of same size from Mussoorie, and it is very different. A description of the animal of this Sutlej valley form is much to be desired, should any conchologist again visit that part of the Himalayas.

AUSTENIA ? VENUSTA, Theob. (Plate LIX. figs. 5, 5 *a*.)

Locality. Arakan (*Theob.*).

Helicarion venustum, Theob. Journ. A. S. B. 1870, p. 400; 1877, p. 24 (is another species).

Vitrina venusta, Hanley, Conch. Ind. p. 61, pl. clii. fig. 5, from Arakan Hills, between Tongoop and Prome *.

Helicarion (sec. B) *venustus*, Theob. Supp. Cat. p. 23.

Vitrina (sec. 2. *Phenacolimax*) *venusta*, Pfr. Cless. Nomen. Helic. Vivent. p. 27 (1881).

Helicarion (*Austenia*) *venustus*, Nevill, Hand-list, p. 16. no. 32, from Arakan, Yunnan, and Kakhyen Hills: as No. 33 (*H. solida*, G.-A.) is referred to this shell with a query, I doubt if the identification of these species is correct; typical *venustus* is quite different from *cacharica*=*solida*, which is the species Nevill had before him.

Original description:—" Vitrina ? venusta. *Testa ovato-auriforme, supra vix convexa, diaphana, tenuissima, polita, subrugose striata, læte flavescente brunnea; anfractibus* 1½ *celerissime crescentibus; apertura latissima.*

" Diam. major 0·30, diam. minor 0·17, alt. 0·10 inch.

" Habitat prope ' Chuegale Sakan, montibus Arakan ' dictis inter Tonghup et Prome."

Mr. Theobald compares it with, and considers it closely allied to, the Nilghiri *V. auriformis*; but a comparison of the shells alone will show they are quite different, while now we know the slug-like forms of Southern India are a widely divergent group.

Under this species Nevill writes as follows, in his paper on the Mollusca of Upper Burmah and Yunnan:—

" Dr. Anderson brought back from Ponsee, in Yunnan, numerous

* Sent me by Mr. Theobald.

specimens (preserved in spirit) of a small form, the shell of which I am unable to distinguish from typical Arakan specimens of *Helic. venustum*, only differing in apparently being of a smoother and more polished texture, and in the spire being a shade more distinctly convoluted; a single specimen of *Helic. solidum* from the Naga Hills is quite undistinguishable from the above Arakan specimens The figures in the 'Conch. Indica' of the two forms are, however, so distinct, that the types will have to be re-examined." I am now able to do this, having received from Mr. Theobald two specimens of *H. venustum* (Plate LIX. figs. 5 & 5 *a*), which prove on comparison to be quite a different form from my *H. solidum*, or even *cacharica*. Mr. Nevill had before him this last species from the Naga Hills, which I have since separated from the species from Hengdan Peak, on the Burrail Range. Dr. Anderson's specimens are no doubt very like, as regards the shell, to the Naga-Hills form; but I should doubt its being the same species, and ranging so far to the eastward, knowing as we do how very limited is the range of the better known forms. The Yunnan shell I therefore must distinguish by the title *G. ponsiensis* (No. 32 of Nevill's List). The single specimen from Nampura, Kakhyen Hills, is probably another local form, while the two specimens from Arakan, evidently not like typical *venusta*, but similar to Naga-Hill shells, require naming when a description of the animal is recorded.

We next have some forms which can still be grouped in *Girasia*, but differing somewhat. The hinder portion of the foot is short. The shell rests in a more or less V-shaped depression below the ridge of the foot; the shells more developed; the shell-lobes reduced in size. The odontophore with much fewer teeth in the row.

Subgenus Ibycus, Heynemann.

Ibycus, Heynem. Malakoz. Blätter, 1862, p. 142, pl. i. fig. 3.

Original description:—"The only specimen not belonging to Anadenus seems to me to be also new, but unfortunately it was in such a condition, the back part and pieces of the mantle entirely wanting, that a diagnosis is impossible; still the remaining part, although badly preserved, showed sufficiently that it did not belong to any known species. While the jaw by its prominent centre pointed to relationships with *Limax*, the regular and inner shell shows a completely different formation. Even the mantle-lobes show so pronounced a papillate surface that it probably did not possess the wavy rings of *Limax*. The mantle covers the fore half of the body, which is grown together with the sole as in *Limax*; it contains a curved, horny, brittle, transparent amber-coloured, strongly lustrous inner shell, with elegant rings of growth. (The

oldest portion including the nucleus was not preserved.) The lung-opening seems to lie far to the front; the cross rows of the radula form an angle in the middle, and run like the sides of an isosceles triangle to the back, so that a separate row with its accompanying somewhat prominent middle tooth looks like a flock of herons; tooth-plates small, and do not touch each other, except in the middle. From them the shovel-like (*i. e.* the pointed kind) tooth rises high up and over the plates; middle tooth-plate above and below much widened, the shovel rises up like a spoon and is connected with the plate by a kind of bridge. The first side teeth are similarly shaped, and have on the side near the edge, far below, an attachment, which through the bridge is also connected with the plate, but soon this attachment rises higher and becomes an equally good point. This form continues towards the end, where I observed in the not fully developed teeth a third point rather far down; this rises on the following teeth higher and higher up, culminating finally in the next adjacent tooth. I know of no similar tooth-formation among the slugs or other snails, and while *Anadenus* represents our *Arion* in the Himalaya, this species is probably there a type peculiar to the country."

GIRASIA (IBYCUS) SIKKIMENSIS, n. sp. (Plate LIX. figs. 2, 2 *a*, animal; 2 *b*, shell.)

? *Ibicus fissidens*, Heynemann.

The animal, from the spirit-specimen, appears to be of a pinkish grey when living. The mantle finely papillate, and finely sprinkled with small black spots, a few similar distant markings on the side of the foot behind.

Hab. About a mile south of Chungthang, on the Chakang stream, about 9500 feet. Independent Sikkim, December 1883 (*W. Robert*).

The Generative Organs. The male organ has an elongate kalc-sac; the amatorial organ is stout, short, and blunt.

Odontophore. The centre tooth of the radula is strongly tricuspid; the median are as usual, the laterals, as in *A. gigas*, bicuspid; the inner point much longer than the outer; in other words, the outer cusp is situated some distance below the apex of the tooth. The extreme outside laterals become very small.

Jaw with a prominent central projection.

I have very little doubt that this and similar forms from Darjiling represent the genus *Ibycus* described by Heynemann from a specimen collected by one of the brothers Schlagintweit in the same neighbourhood. Heynemann unfortunately had only an imperfect specimen to describe, which wanted the entire hinder part and portion of the mantle, and even the shell had lost the apex. Nevertheless, from certain characters, such as the papillate surface of the front part of the mantle, the type of shell (shovel-shaped), and the jaw with prominent centre, and the description of the radula, his species would come in here. Although the generic position can be cleared

up, it will be impossible to distinguish his species where several exist; and as this group is certainly a remove from the typical *Girasia* in at least three points of structure (shell-lobes, shell, and radula), Ibycus might be retained for it, and quite as well, if not better, than placing it in a section distinguished by a letter of the alphabet.

Girasia (Ibycus) sikkimensis, var. mainwaringi, n. sp. (Plate LIX. figs. 3, 3 *a*, 3 *b*, animal.)

Hab. Darjiling.

This animal, when living, must have been very dark-coloured; the mantle-lobes finely papillate throughout; the right shell-lobe is somewhat narrow, and is united to the left, which shows a small tongue-shaped expansion on the left frontal margin; the dorsal lobe is very largely expanded. The foot is very short behind and cut off square. The shell is, like that of *sikkimensis*, broad in front.

I have only a single specimen, which was obtained by Col. Mainwaring; it is small, the papillation of the mantle is coarser than in *sikkimensis* and its colour distinct; yet it is of similar form, and I can only consider it a dark variety.

The jaw has a central projection.

Girasia (Ibycus) cacharica, n. sp. (Plate LIX. figs. 4, animal, 4 *a*, 4 *b*, shell; Plate LXII. figs. 5, 5 *a*, 5 *b*, and 5 *c*.)

Helicarion solidum, Godwin-Austen, Journ. A. S. B. 1875, p. 6, pl. ii. figs. 5, 5 *a*, 5 *b*, 5 *c*, 5 *d*.

Helicarion (*Austenia*) *solidus*, Nevill, Hand-list, p. 16. One from Naga Hills, collected by Major Godwin-Austen.

Locality. North Cachar Hills.

Shell flat, horny, smooth, shining, with concentric lines of growth; colour pale olivaceous brown (in type) or green, mature specimens more shelly and milky white within; apex very small and rather closely wound; of one single whorl; aperture ovate.

Size: maj. diam. 10·0, min. 6·0 mm.

Animal. Is much speckled throughout, and with black bars on the side of the foot. The dorsal lobe very ample, extending round to the left posterior side; the right dorsal lobe rather small. The right shell-lobe is expanded over the apex, but is hardly connected behind; the left shell-lobe is narrow, and laps over the peristome, but does not join the other lobe. The posterior margin and apex of the shell rests in a V-shaped depression of the ridge of the foot as in *Girasia hookeri*, and the hinder part of the foot thence to the mucous gland is very short.

Generative Organs (Plate LXII. fig. 5 *c*). The amatorial organ is present, and the point of the dart is bent nearly at right angles to the main portion (*vide* fig. 5 *b*, Plate LXII.).

Odontophore (Plate LXII. fig. 5). The large number of broad central teeth is peculiar; they have a well-formed cusp on the outer basal side. All the laterals are very pointed and curved, with the

outer cusp low down, quite basal, so that they are almost unicuspid; these become very small on the outer margin.

40 . 15 . 1 . 15 . 40
55 . 1 . 55

The jaw with a large central projection (Plate LXII. fig. 5 *a*).

This is the form I described in 1875 as *Helicarion solidum*. It has somewhat the form of a small *G. hookeri* when alive. A specimen from Kohima was dark umber, pinker below, with no mottling on the body; tentacles dark.

In another specimen from the Dunsírí valley, Assam, the animal was pinkish grey with dark mottling, the mantle covered the whole shell and had a slight indentation on the extreme anterior margin (an individual peculiarity); the mucous gland with small lobe above, the extremity of foot cut off rather square.

Total length 2·70, mantle 1·3, mantle to head 0·5 in.

Shell: major diam. 0·44 in.

GIRASIA (IBYCUS?) CINEREA, G.-A. (Plate XL. fig. 8, from life.)

Helicarion (*Hoplites*) *cinereus*, Godwin-Austen, Journ. A. S. B. 1876, p. 314, pl. viii. fig. 2, animal.

The shell was not described when taken, and it has since been mislaid. The description of the animal, which was made at the time, is as follows:—"Animal when fully extended long and narrow, colour dusky grey; mantle with a papillated surface slightly spotted, the spotting being coarser on the body and tail. Tentacles short and bluish, with the oral very close below them.

"Length 0·75, mantle 0·40 in.

"*Habitat*. On the Darpang river, at foot of the Dafla Hills, under old logs in the forest."

GIRASIA (IBYCUS?) SOLIDA, G.-A.

Helicarion (*Hoplites*?) *solidus*, Godwin-Austen, P. Z. S. 1872, p. 518, pl. xxx. fig. 10.

Helicarion solidum, Godwin-Austen, Journ. A. S. B. 1875, p. 6 (pl. ii. figs. 5, 5 *a*, 5 *b*, 5 *c*, 5 *d*, is a different species, vide *cacharica*).

Vitrina solida, Hanley, Conch. Ind. p. 61, pl. clii. fig. 6 (bad drawing).

Helicarion (sec. B) *solidus*, Theob. Supp. Cat. p. 23, not from hills below Cherra Poongee.

Helicarion (*Austenia*) *solidus*, Nevill, Hand-list, p. 16, from Naga Hills, is *G. cacharica*.

Locality. Hengdan Peak, North Cachar Hills.

Original description:—"Animal not seen.

"Shell flatly convex, periphery oval, solid, not horny; epidermis reddish brown; spire short, apex very flat; one single body-whorl; peristome simple, thin.

"Diam. maj. 14·0, minor 8·0 mm.
,, 0·57, ,, 0·32 inch.

"This shell was found at Hengdan Peak, North Cachar Hills, but I never obtained a living specimen. I have, however, figured the shell, with the hope that a description of the animal may some day follow."

The shell differs much from *cacharica* in form of apex and its solidity, but the animal is, I have no doubt, very similar in form.

Subgenus Dekhania, Godwin-Austen.

Type *D. beddomei*, G.-A.

Animal. In general form like *Girasia hookeri* of the Khasi Hills, the posterior portion of the body being about equal to the part of the mantle covering the shell. The dorsal and shell-lobes are all united in an oval mantle or shield, leaving only a minute orifice like a pinhole in the posterior median side; the shell is only shown to this extent in the contracted spirit-specimens, so that in life and fresh it must be completely hidden. From this small opening a distinct line or cicatrix runs towards the respiratory aperture on the right side, indicating that it is the remnant of a form, perhaps extinct, in which the shell-lobes were originally separated into right and left lobes. The whole mantle rests deeply below the ridge of the posterior portion of the foot, in a depression which is square behind, not V-shaped. The pedal groove or line is not so deep and well shown as in *Girasia*, and the segmented margin is narrower. The extremity of the foot is cut off square, the mucous pore being a narrow vertical slit, extending to the sole of the foot.

The generative aperture is posterior to the right tentacle.

The shell. This is of an extremely solid, shelly character, oval in form, dextral, white, marked with close, concentric lines of growth, flatly convex above, flat and smooth beneath, its internal side is thus completely filled with shelly matter; apex solid.

The generative organs are like those of *Girasia*, save that the amatorial organ is not so large.

The odontophore (Plate LXII. figs. 7, 7 *a*) presents a considerable departure from *Girasia*, both in the shape and far greater number of the teeth in the row. The centrals are broad and triangular, with small basal cusps; the median evenly bicuspid, the lateral becoming very minute on the margin.

The teeth are arranged as follows:—

122 . 5 . 21 . 1 . 21 . 5 . 122
148 . 1 . 148

The jaw is solid, semicircular in form, with a slight projection on the concave cutting-edge.

There seem to be many local varieties in the collection, differing in coloration only (just as *Arion* of our European area is seen to

vary) from very pale ochre to black or dark blue, spotted and unspotted, and all except one specimen have a very noticeable dark line on the foot-ridge, extending from the mucous pore to the depression in which the shell and mantle rest.

This interesting mollusk I have named after its discoverer, Colonel R. Beddome, who most kindly placed all his spirit-specimens at my disposal.

It adds another genus to the rich store in natural history and botany that were brought together by him, when Superintendent of the Southern Indian forests, and which, but for his zeal as a collector and knowledge of zoology, would still be buried in those wilds unknown to science. There are many new species, if not genera, still to be described in this collection, and I can only repeat that I have not sufficient time to bring them to notice more quickly than I have hitherto done.

This genus is a most interesting one, from its similarity to *Girasia* of the N.E. frontier of India, to which it is closely related, as shown in its internal anatomy, while it yet shows such strong variance of form in the remarkable shell, and its almost complete envelopment by the mantle, and the great difference in which this portion is set upon the foot, a departure pointing to very long separation under distinctly different conditions of life.

GIRASIA (DEKHANIA) BEDDOMEI, n. sp. (Plate LVIII. figs. 1, 1 *a*, 1 *b*, animal, figs. 2, 2 *a*, 2 *b*, shell; Plate LXII. figs. 7, 7 *a*.)

Locality. Travancore Hills.

Size of shell figured: maj. diam. 1·37, min. 6·5; alt. axis 2·0 mm.

Animal. Would be probably 4 inches long when alive. Of a uniform ochre colour throughout. Mantle not papillate; a narrow dark line on the keeled ridge of the foot behind.

GIRASIA (DEKHANIA) BEDDOMEI, var. NIGRA. (Plate LVIII. fig. 5.)

Locality. Travancore Hills.

Animal. The specimen drawn is smaller than the last. It is of a deep grey-black colour over all the upper surface, the sole of the foot being alone colourless.

GIRASIA (DEKHANIA) BEDDOMEI, var. MACULOSA. (Plate LVIII. figs. 4, 4 *a*.)

Very similar in colouring to the first described, with the addition of blotchy spottings on the mantle, which are more run together on the hinder part of the foot.

GIRASIA (DEKHANIA) BEDDOMEI, var. MACULOSA. (Plate LVIII. figs. 6, 6 *a*, 6 *b*.)

Is taken from a much less mature individual. The mantle is somewhat larger in front and expanded, covering the head.

Genus Africarion (*continued from* p. 154, Part IV.).

Africarion ater, n. sp. (Plate LVII. figs. 1, 1 *a*, 1 *b*, 1 *c*, animal; figs. 2, 2 *a*, 2 *b*, shell.)

Locality. Travancore and Tinevelly Hills (*Col. R. Beddome*).

Animal. About 50 mm. or 1·9 inch in length, when living, the hinder part of the foot apparently long and narrow, with a small linear mucous pore overhung by a small lobe, the pallial line and margin very narrow. The rounded dorsal surface of the posterior portion of the foot is divided at its anterior end into two well-developed lappets forming a deep V-shaped depression, and in this the shell is sunk, and the two lappets envelope on both sides the dorsal lobes. The right shell-lobe is small, obtusely angulate, extending towards the apex, and continuous round to the left posterior margin, gradually narrowing; neither extend to the posterior margin. The right dorsal lobe is very small, extending from the respiratory orifice to the posterior right margin. The left is ample in front, but contracts in breadth gradually up to the left posterior margin, where it becomes a mere thread in size, and passes round behind to join the right dorsal lobe, just on the margin of the very thin membranaceous extension of the shell. The foot has a central and marginal area, divided into three equal parts, the edge being segmented *.

The shell is flat above, dextral, broadly ovate, smooth, shiny, colour green, white at the apex and within the shell; whorls about $1\frac{1}{2}$; the edge of the expanded aperture is very thin; attached to and continuous with the flat more shelly portion is a curtain-like membrane which falls over and covers the posterior part of the body of the animal. It is exceedingly difficult to remove the harder shelly portion without breaking away this portion of it, but I show it in figs. 4, 4 *a*.

Major diam. 12·5, minor diam. 7·0 mm.

Odontophore. The radula has the centrals and laterals on both sides nearly equal in number; the centrals are elongate tricuspid teeth; the laterals rather small and bicuspid, as in the African species figured Plate XLII. fig. 6.

The formula is

$$\begin{array}{c} 24 \;.\; 1 \;.\; 19 \;.\; 1 \;.\; 19 \;.\; 1 \;.\; 24 \\ 44 \;.\; 1 \;.\; 44 \end{array}$$

The jaw (Plate LVII. fig. 3 *c*) is dark coloured, with a central projection.

The generative organs (Plate LVII. figs. 5, 5 *a*) are simple, with

* On removing the shell it is seen that this mollusk has at the apex the dextral coil in a much more pronounced degree than is usual in the slug-like forms; the small hooked process of the liver-lobes which fills the apex of the shell is not so developed in *Girasia*, &c., or even in the African species I have previously described. Although very distinctive, I have not considered it of sufficient importance to separate it generically from this last. It indicates relationship to some form possessing a more developed spiral shell.

no dart-sac, the spermatheca short, a globular sac on a short tube; the male organ simple, bent on itself at the retractor muscle. The spermatophore is very peculiar, and is formed in an expansion of the tube, where the vas deferens unites with it. The albumen-gland very large.

This is an extremely interesting species, for in many respects it is similar to *A. pallens*, from Abyssinia, the differences that are to be found being only modifications of the same parts in the latter.

There are several varieties in Colonel Beddome's collection, from the same hills, differing only in colour: these I indicate as follows:—

Var. ATERRIMA. (Plate LVII. figs. 3, 3 *a*, 3 *b*, animal; figs. 4, 4 *a*, shell.)

This would appear, when living, to be a rich grey-black, the sole of the foot, which in *ater* is entirely pale, is in this variety bordered with black, only the ambulatory central area being pale brown; on each side of the extremity of the foot there is a blacker band of colour.

Var. CINEREUS. (Plate LVII. fig. 8, animal.)

Is of a pale ash colour, with a distinct dark band on the side of the foot behind, which is again seen on the side of the head; the rest of the body and mantle are mottled throughout.

Var. CASTANEUS.

Is a rich chestnut, with dark markings similar to the last two.

These varieties (divergency confined to coloration alone) are just what we find in such forms as *Arion ater* in Europe.

To Colonel R. Beddome conchologists are indebted for the collection of this extremely interesting species, and its preservation in spirit, which has enabled me to now give them its description; and I take this opportunity of thanking him for placing it and so many other shells in my hands.

To this must be allied—

AFRICARION AURIFORMIS, W. T. Blf. (Plate LVII. figs. 7, 7 *a*, figured from type in Mr. Blanford's collection.)

Vitrina auriformis, W. T. Blanford, Journ. A. S. B. 1866, p. 36.
Helicarion (sec. B) *auriformis*, Theob. Supp. Cat. p. 23.
Helicarion (*Austenia*) *auriformis*, Nevill, Hand-list, p. 16.

Original description:—"Shell very depressed, irregularly ovate, ear-shaped, very thin, striated, polished, with a membranaceous epidermis, greenish or brownish yellow in colour, paler at the nucleus. Spire flat, suture slightly impressed. Whorls $1\frac{1}{2}$. Aperture oval, occupying the whole under part of the shell, and exposing the interior to the apex; peristome membranaceous.

"Length 13·0, breadth 8·0, height $2\frac{1}{2}$ mm.
,, 0·52, ,, 0·32, ,, 0·1 inch.

"*Habitat.* Sispara Ghat, Nilghiri Hills, Southern India."

"This species is very near *V. gigas*, Bens., and still more closely allied to *V. peguensis*, Theob., being, however, a more depressed species than either, and more open. It is also less solid than the last-named species. I have not met with the animal, which may possibly differ from those of other *Vitrinæ*.

"If the animal resemble those of *V. gigas* and *V. peguensis*, the occurrence of this mollusk on the western flank of the Nilghiri Hills will be one of the most anomalous with which I am acquainted amongst the land-shells of India, since I know of no other instance of a Malayan type, unrepresented on the Himalayas, of which species occur on the hills of Southern India.

"A small auriform shell such as this may, however, have been easily overlooked, and the Himalayan molluscan fauna is probably far from thoroughly known.

"The animal of *V. peguensis* has been partly described by Mr. Theobald, who, however, has unfortunately not mentioned the form of the mantle, the presence or absence of lobes covering the shell, nor the existence of a caudal gland, unless the expression '*caudali papilla nulla*' is intended to imply its absence; more probably Mr. Theobald's meaning is that the overhanging lobe, so conspicuous in some forms of *Nanina*, is absent, the gland existing as in *Ariophanta*, &c.

"This *Vitrina* is not the only South Nilgiri species. A larger membranaceous form also occurs, which requires comparison with Mr. Benson's *V. membranacea* from Ceylon."

These remarks of Mr. Blanford, written when so very little was comparatively known of the Indian land-shells, may now be read with interest, and show that he was then impressed with the remarkable diversity and distinctness of form that is to be found between the Southern Indian and Malayan types. *A. peguensis*, as I shall show further on, is widely different from this Nilgiri genus, as well as from *gigas*. But more remarkable is the fact that this South-Indian mollusk is so similar in its organization to the African form which I have fully described, so similar that there is no character of importance to separate them generically. This is only another proof, which Mr. Blanford has shown us long ago, of the remarkable relationship in the fauna of Eastern Africa and Southern India, and their probable former land-connection.

Subgenus Bensonia, Pfeiffer. (Plate LXI.)

As a 5th subgenus of *Nanina*, Pfeiffer, Malak. Blätt. 1855, p. 119; type taken and the first on the lists, *N. labiata*, Pfr.

Bensonia, Nevill's Hand-list, p. 49 (1878), type *N. monticola* = *labiata*; Pfr. Nomen. Helic. Vivent. p. 41 (1878), type *N. labiata*.

Pfeiffer did not describe this subgenus, which was based on shell-characters alone. He included in it the following species :—

Nanina labiata, Pfr.
—— *orobia*, Bens., = *Oxytes.*
—— *tugurium*, Bens., = *Macrochlamys.*
—— *splendens*, Hutt., = *Macrochlamys.*
—— *afra*, Pfr.

The last, from the Cape of Good Hope, is not likely to be in any-way related subgenerically to a Himalayan form.

Specimens of the Mussoorie species *labiata* have been most kindly sent me by Mr. J. B. N. Hennessey, F.R.S., of the Indian Survey Department; I am thus able to give a description of the animal.

Animal. The mucous pore has a broad overhanging lobe. The right dorsal lobe simple, with no right shell-lobe; the left dorsal lobe is divided into two parts, as in the genus *Oxytes*; the posterior portion is isolated and not well developed, yet somewhat larger than in *Oxytes cycloplax.* The animal is also similar to *Oxytes* in its markings and in the form of the extremity of the foot.

The generative organs (Plate LXI. fig. 5) are on the same plan, and may be compared with those shown on Plate XXXI. fig. 7 and Plate XXXII. fig. 5, particularly well seen in the male organ. There is therefore no necessity for repeating the description; the amatorial organ (D) is long and there is a lengthened pointed cæcum or kale-sac (K). I examined two specimens and was rewarded by finding in the spermatheca (*sp*) of the specimen on Plate LXI. fig. 5, a bundle of perfectly developed spermatophores of beautiful structure; this was a most interesting discovery, for the form this organ assumes in this group of land-shells I do not think has yet been described. The single spermatophore or *capreolus* is a long, narrow, chitinous ribbon, folded on itself longitudinally to form a shallow gutter (see fig. 5 *e*, which is magnified 4 times); the edge or rim of the gutter is set at regular intervals with little spikes bifid at the point; they increase in size from one end (f'') towards the broader end of the spermatophore (f'), which at last widens into a spatula-like or probe-like end (5 *f*). Here the long bag or sack is attached and the thin membrane is probably continuous over the open part of the gutter-like portion below; this bag terminates in a hard nipple-like end or capsule.

The odontophore does not compare with that of *Oxytes* in any way, either in general form (as a set) or number in each row, the central and median teeth being much more like the ordinary form seen in *Macrochlamys*; and yet the unicuspid laterals that come in about the 36th tooth are, however, similar to those teeth in *Oxytes*, a sort of passage, as it were, from one to the other. The central tooth (5 *a*) is strongly tricuspid, the median with an inner high cusp and an outer lower cusp; the lateral (5 a') are bicuspid, with the outer remote from the point disappearing at the 36th to 38th tooth (5 a''): unicuspid teeth follow, and the outermost laterals (5 a''') are very minute.

The formula is

$$70 \;.\; 2 \;.\; 19 \;.\; 1 \;.\; 19 \;.\; 2 \;.\; 70$$

or

$$91 \;.\; 1 \;.\; 91 \pm$$

Jaw with central projection.

OXYTES (BENSONIA) MONTICOLA, Hutton.

Nanina monticola, Hutt. & Bens. J. A. S. B. vol. vii. (1838), p. 215 (Mahasu, *Hutton*).

Helix labiata, Pfr. P. Z. S. 1845, p. 65 (locality unknown, ex mus. *Cuming*); Pfr. Monogr. Helic. Vivent. vol. i. p. 73 (Landour, *Hutton*).

Helix monticola, Pfr. Monogr. Helic. Vivent. vol. i. p. 130 (Mahasu, *Hutton*; Landour, *Benson*).

Hemiplecta labiata, Pfr.; Albers, Die Heliceen, 1850, p. 61.

Xesta labiata, Pfr.; Albers, Die Heliceen, 1861, p. 51.

Orobia monticola, Hutton; Albers, Die Heliceen, 1861, p. 58.

Helix monticola, Hutton; Han. & Theob. Conch. Ind. p. 25, pl. lii. f. 3 (Huttu and Mahasu) *.

Helix labiata, Pfr.; Han. & Theob. Conch. Ind. p. 13, pl. xxvii. f. 5, good figure (Landour).

Hemiplecta monticola, Hutton, sec. C, = *labiata*, Pfr. Theob. Cat. Supp. p. 22.

Hemiplecta monticola, Theob. J. A. S. B. 1878, p. 142.

Nanina (*Bensonia*) *monticola*, Hutton, = *labiata*, Pfr. Nev. Hand-list, p. 49.

Bensonia labiata, Pfr. Nomen. Helic. Vivent. p. 41.

Bensonia monticola, Hutton; Pfr. Nomen. Helic. Vivent. p. 42.

Mussoorie, N.W. Himalaya.

The first record of a shell of this subgenus is in a paper by Hutton and Benson, published in 1838 on the land and freshwater shells of the Himalaya, named *Nanina monticola*, Hutton.

Original description:—" *Testa subdiscoidea, pallide vel saturate brunnea, epidermide radiatim et concentrice rugosula; spira depresso-conoidea, apice obtusata; peripheria minime angulata, suturis leviter impressis, apertura transversa, lunata, labro costa interni submarginali albida minuto.* Diam. 1·75 inch. (B.)

" Umbilicus as in the genus. The shell has a moderate polish, and is sufficiently distinguished from *vitrinoides* on the one hand, and from *decussata* on the other, by the radiating wrinkles interrupted by concentrically disposed, depressed lines, which give the surface of the shell a rough aspect, very different from the decussated surface of *decussata*. . . . The larger specimens of *N. monticola* attain a considerable thickness, and there are visible three or four internal varices at various distances, occasioned by the ribs at the apertures of former growths.

* Is a good figure of the Mussoorie form. I think Hanley has transposed the localities of the shells he figured on pls. xxvii. and lii. (*vide* G. Nevill, Moll. Yark. Exped. p. 17).

". . . The colour of the animal is a dirty brown. The dark coloured variety is the more frequent of the two, although both occur of every size. They are abundant at Mahássú under fallen timber, and in the rainy season they climb the stalks of plants, feeding upon the leaves. The largest specimens occur at Hattú, among the ruins of the old forts which crown the mountain. Young specimens were met with among junipers at Liti, at an elevation not much under 14,000 feet. (B.)."

This species has a very wide range over the N.W. Himalayas. I am not at all certain that the very large Mussoorie form *labiata* is the same exactly as Hutton's *monticola.* I have never seen any shells of large size from the Simla neighbourhood, to be able to compare the two. I have a fine series from Mussoorie, all with a low spire; periphery well rounded, not subangulate, and often banded. I think *labiata* should stand as a variety of *monticola.* The following are the measurements of Mussoorie specimens:—

1. Banded: maj. diam. 43·0, min. diam. 37·0, alt. axis 17·0 mm.
2. Plain: ,, 41·0, ,, 34·5, ,, 19·3 mm.
3. Plain: ,, 38·5, ,, 33·0, ,, 15·0 mm.
4. Young specimens with 5 whorls: maj. diam. 22·5, min. diam. 19·5, alt. axis 8·5 mm.

A sketch made in my note-book of the extremity of the foot of this specimen shows it to have a long horn-like lobe above the mucous gland.

"Animal yellowish green, foot very long."

A specimen from Simla collected and given me by Stoliczka agrees well with the original description, and also with that in Pfeiffer, and this shell is also like two specimens in Mr. W. T. Blanford's collection.

OXYTES (BENSONIA) MONTICOLA, Hutton.

Simla (*Stoliczka*).

Shell depressedly conoid; sculpture longitudinal well cut lines, crossing the more irregular lines of growth, but not decussate; colour pale sienna-brown, with darker brown edging near the peristome; spire subconoid, moderately high, the sides flat; suture shallow; whorls 7, not convex, closely wound, the last obsoletely angulate; aperture lunate; peristome sharp and strong; columellar margin oblique.

Maj. diam. 26·0, min. 22·5, alt. axis 12·8, alt. body-whorl 9·8 mm.

Description in Pfeiffer:—

"338. HELIX MONTICOLA (NANINA), Hutton.

"*T. perforata, depressa, subdiscoidea, fusco-cornea, striata, lineis concentricis, confertis minutissime reticulata; spira vix elevata, apice obtusata; anfr.* 6, *vix convexiusculi, ultimus obsolete angulatus; sutura leviter impressa; apertura lata, lunaris; perist. simplex, rectum, intus callo albido late labiatum, margine columellari vix reflexo.* Diam. maj. 26, min. 17 (? 22), alt. 10 mill. (spec. Mus. Britt.). Diam. 1·75 poll. (*Hutt.*). [Min. diam. 17 must be a mistake.—G.-A.]

"*Nanina monticola*, Hutt. in Journ. As. Soc. vii. p. 1, p. 215.

"*Nanina convexa*, Bens. in sched. Cuming.

"Habitat in Himalaya ad Mahassu (*Hutt.*), Landour (*Bens.*).

"*Obs.* Similis *H. labiatæ* (no. 164) forsan hoc loco enumerandæ; differt anfractuum numero, sculptura, etc."

"164. Helix labiata, Pfr.

"*T. aperte perforata, depressa, tenuis, striatula, superne lineis concentricis obsolete decussata, basi lævigata, nitida, fulva; spira planiuscula; anfr. 6 subplanulati, ultimus dilatatus, depressus; apertura lata, lunaris; perist. acutum, plerumque rufescens, intus calloso-labiatum, margine supero antrorsum rotundato, basali plane subarcuato, columella vix reflexiuscula.* Diam. maj. 40, min. 35, alt. 20 mill. (coll. No. 93).

"*Helix labiata*, Pfr. in Proc. Zool. Soc. 1845, p. 65 (locality unknown); Chemn. ed. ii. Helix, iv. p. 182, t. 35. f. 6–8.

"*Nanina bensonis*, Hutt. in sched. Cuming.

"Habitat prope Landour, Indiæ Orientalis (*Hutton*).

"*Obs.* 1. Similis *H. citrinæ*, differt sculpturâ, anfractuum arctiorum numero, perforatione apertâ, in adultis membranâ tenui clausâ, et labio.

"*Obs.* 2. Huic affinis videtur *H. monticola*, Hutton (No. 338), forsan hic collocanda.

"The banded variety which is common at Mussoorie is precisely the same in every respect, but not quite so numerous as the other described above; the band is situated just above the periphery, and is near 4 mm. in width."

Theobald writes under—

Hemiplecta monticola, Hutton.

"Generally distributed throughout the Western Himalayas. In the valley of the Bichlári River, an affluent of the Chenab, this species occurs remarkably fine and in incredible numbers in the fissures of rock, though few live specimens were procurable at the time of my visit. The colour of the shell is dark chestnut, both above and below, and there are four or five prominent pale bars or transverse stripes, marking the seasonal arrest of growth and the position of successive epiphragms, formed during the period of hybernation. The epidermis is very thin and a pale yellow, and the shell does not attain maturity under seven or eight years. The first five whorls are minutely shagreened; the remaining ones smooth, but more or less transversely rugose.

"My largest specimen measures 47 × 39 × 23 mm. The species is particularly common below Nachilana in the Bichlári valley."

There is a small variety in Mr. Blanford's collection, also from Stoliczka, from Fagu, near Simla, with the same well-marked varices of growth; it has the full number of whorls, but only 19·25 mm. in maj. diam.

From Kotgurh, on the river Sutlej, I possess another variety, similar in type of sculpture, but of darker colour and closer, more regularly wound whorls, and very depressed in form; it has 7 whorls, and is 19·0 mm. in maj. diam. This differs more from the type than any I have examined; but as it is a single specimen, it is better not to name it.

G. Nevill in his Hand-list of shells in the Indian Museum, Calcutta, gives the following species:—

"No. 267. BENSONIA MONTICOLA, var. MURRIENSIS, Nevill, Second Yarkand Mission, Mollusca, p. 17.

". . . differs in the characters which separate it from the type, namely open umbilicus, compressed whorls, more vertical aperture, and peculiar, abruptly raised apical whorls." Only one specimen was found at Changligulli, near Murree. A series is wanted from this locality.

"No. 267. Var.?

"From Kumaon.

"No. 269. BENSONIA, n. sp.

"From Narkanda, Mussoorie, and N.W. Himalayas.

"This I suspect is only one of the many forms of *monticola*, not worthy of a specific name.

"No. 273. BENSONIA KULUENSIS, Nevill, MS. in epist., 22nd Aug., 1880.

"Kulu.

"No. 273 *a*. BENSONIA THEOBALDIANA, Nevill, MS.

"This shell was sent me in Sept. 1880, and referred to in the above letter as distinct from *kuluensis*; it appears to me to be only a slight variety of *monticola*."

OXYTES (BENSONIA) JAMUENSIS, Theob.

Hemiplecta jamuensis, Theob. Journ. A. S. B. 1878, p. 142.

Original description:—"*Testa solida, convexa, anguste umbilicata, supra levissime granuloso-corrugata* (H. ligutalæ *modo*), *subtus lævigata. Colare supra pallide brunnea, subtus albida. Anfractibus sex, lente crescentibus. Labio intus incrassato simplici. Attinet ad* 27 × 23 × 14 mm.

"Habitat in 'valle Tawi, inter Chineni et Adampur.'"

This is in the Jamoo Hills, north of Sealkote, in the Panjab; and Adampur must be Udampur.

Theobald says:—"This species might be regarded by some as an impoverished race of the last (*monticola*), from which, I have little doubt, it is proximately derived, but it differs too much in size, colour, form, and range to be properly united. I have unfortunately no live shells, but the type of coloration in my best specimens is more of the type of *ligulata* than of *monticola*, being white below.

It is, I think, clearly a species descended from *H. monticola*, and modified to meet the climatal conditions of the Jawi valley, below Chineni, where the winter cold and summer heat are both more intense than is suitable for *monticola* on the one hand, or *ligulata* on the other." I quite agree with Mr. Theobald as to this being a dwarf variety of *monticola*, which he found in great numbers and of large size in the damper valley of the Chenab, not many miles away. In the dry, hot sandstone hills near Udampur it could not attain to a great size. It is not likely to have any relationship to *H. ligulata*, a form from Peninsular India.

Another species of this genus is possibly :—

Helix angelica, Pfr.

Helix angelica, Pfr. P. Z. S. 1856, p. 33 (Panjab); Pfr. Mon. Helic. vol. iv. p. 123; id. Novit. Conch. i. p. 76, pl. xxi. f. 5–6.

Macrochlamys (sec. A) *angelica*, Pfr. Conch. Ind. p. 36, pl. lxxxvi. f. 5 & 6; Theob. Cat. Suppl. p. 17.

Nanina (*Bensonia*) *angelica*, Nev. Hand-list, p. 49; id. Yark. Mission, Moll. p. 18.

If, as Mr. Nevill writes, *angelica* is allied to *splendens*, it cannot be put into *Bensonia*. The animal of *M. splendens* is quite distinct.

Oxytes (Bensonia) convexa, Reeve.

Helix convexa, Conch. Icon. Hel. pl. 127. f. 762, for *H. monticola*; Reeve, Pfr. Mon. Hel. vol. iv. Addenda, p. 636; Reeve, Han. & Theob. Conch. Ind. p. 36, pl. lxxxv. f. 1–4; Küst. ed. Chemn. Hel. pl. clx. f. 3–5.

Hemiplecta (sec. C) *monticola*, Hutton, *convexa*, Reeve (juv.), Theob. Cat. Supp. p. 22.

A good deal of confusion regarding this species is evident, and I think has arisen from Hutton's habit of transferring a name to another species when he found it preoccupied. I have this species in my collection (No. 54 of my note-book) giving Hutton's identification as *monticola*, dwarf variety, in pencil, in ink on the side *convexiuscula* (perhaps the origin of Reeve's name); *monticola* appears on the label, altered some years after to *convexa*, Reeve. *N. labiata* was his identification of the common large Mussoorie form, showing that he accepted Pfeiffer's name for it, and not his own *monticola*—the Simla species—and considered the species *convexa* a dwarf form of the last *. I collected at Mussoorie for many months and never found *convexa* there, while it was most abundant on the Nagtiba Ranges to the north, and which are higher. I thus described it at the time :—" Shell of a pale brown-pink hue, with irregular dark mottlings; peristome pink edged.

" Animal light brownish green, brown near head; tentacles greenish grey. Foot rather short. Very plentiful under old logs at 9000 feet."

* The young specimens which Hutton noted at Liti were no doubt *convexa*.

The following is a fuller description of it :—

OXYTES (BENSONIA) CONVEXA, Reeve.

Locality. Nagtiba ridge, Mussoorie Hills.

Shell subglobosely conoid, not umbilicated; sculpture very fine, regular, wrinkly, longitudinal ribbing, both above and below; colour bright straw-colour, or umber-brown, a bright ochre transverse band at the peristome; spire moderately high, subconical; apex rounded; suture well impressed; whorls 7, convex: aperture lunate, subvertical; peristome thin, slightly reflected near the columellar margin, which is subvertical.

Size: maj. diam. 16·5, min. 14·75, alt. axis 8·0, body-whorl 7 mm.

Small var. from Kulu: maj. diam. 11·2, min. 9·2, alt. axis 5·75 mm.

This has six whorls, the lines of growth being fine and very regular give the surface a more decussate texture. It was obtained and given me by Ferd. Stoliczka. There are examples of this species in Mr. Blanford's collection from Kamaon, and one from Simla.

A Classification of Families and Genera treated of in the preceding pages, with the exception of some genera whose relative position is still doubtful, such as Kaliella *and* Sitala.

Fam. ZONATIDÆ.

Subfam. ARIONPHANTINÆ.

Genus ARIOPHANTA. Peninsular India and Lower Bengal.
OXYTES. Eastern Himalaya to Burmah.
BENSONIA. N.W. Himalayas.
NILGIRIA, n. g.*, G.-A.; *solata*, Bs. (type). Peninsular India.

Subfam. MACROCHLAMINÆ.

Genus MACROCHLAMYS. India throughout, Burmah, Malayana, and Africa.
MICROCYSTINA. Andaman and Nicobar Islands.
HEMIPLECTA HUMPHREYSIANA †, Lea (type). Malay Peninsula and Islands.

Subfam. HELICARIONINÆ.

Genus GIRASIA. }
AUSTENIA. } N.W. Himalaya to Assam and Burmah.
IBYCUS. }
CRYPTOSOMA. Burmah.
HELICARION. Australia.
DEKHANIA. Peninsular India, South.
AFRICARION. Africa and Peninsular India.

Subfam. DURGELLINÆ.

Genus DURGELLA. Assam, Burmah, and Tenasserim.

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* This will be fully described in the next Part.

† This species, from Singapore, will be described with some of its allies.

EXPLANATION OF PLATE LII.*

Fig. 1, 1*a*. *Austenia scutella*, Bs., × 2·4. Murree, Punjab. Animal viewed from right and left sides.
1 *b*. Ditto: the extremity of foot viewed from behind, × 4.
1 *c*, 1*d*. Ditto: shell, × 2·4. Chinab valley.
1 *e*. Ditto: shell, natural size. Chinab valley.
2, 2 *a*. *Austenia? monticola*, Bs., natural size. Mussoorie, N.W. Himalaya.
3, 3 *a*. ——? *stoliczkanus*, Nevill, × 1·6. *Almorah*, N.W. Himalaya.
3 *b*. —— ——, natural size.
4, 4 *a*. ——? *serahanensis*, G.-A., × 1·6. Sutlej Valley, N.W. Himalaya.
4 *b*. —— ——, natural size.
5, 5 *a*, ——? *theobaldi*, G.-A., × 1·6. Bichlari, Chinab Valley, N.W. Himalaya.
5 *b*. —— ——, natural size. Bichlari, Chinab Valley, N.W. Himalaya.

EXPLANATION OF PLATE LIII.

Fig. 1.	*Macrochlamys? consepta*, Benson, × 2·4.	Moulmain, Tenasserim.
2.	—— *woodmasoni*, Nevill, MS., × 4.	Little Coco Island, Bay of Bengal.
3.	—— *hepatizon*, G.-A., × 2·4.	Habiang, S.W. Khasi.
4, 4 *a*, 4 *b*.	—— ——, × 2·4.	Dafla Hills.
5.	—— *patane*, × 4.	Darjiling.
6.	—— *petasus*, Bs., × 4.	Phie Than, Tenasserim.
7.	—— *subpetasus*, G.-A., × 4.	Arakan.
8, 8 *a*.	—— *latus*, G.-A., × 2·4.	Teria Ghat, Khasi.

EXPLANATION OF PLATE LIV.

Fig. 1. *Macrochlamys flemingi*, Pfr. Murree. Right side. From spirit-specimen, natural size.
1 *a*. Ditto: left side.
1 *b*. Ditto: posterior view of the mucous gland, × 4.
1 *c*. Ditto: the head, showing position of the generative orifice and the groove running back from it, under the mantle-lobes.
1 *d*, 1 *e*. Ditto: shell, natural size.
2, 2 *a*. *Macrochlamys altivagus*, Theob., natural size. Uri, Kashmir.
3, 3 *a*. —— *cassida*, Bs., natural size. Kashmir.
4. —— *austenianus*, Nevill, natural size. Sonamurg, Kashmir.
4 *a*, 4 *b*. Ditto, × 2·4.

EXPLANATION OF PLATE LV.

Fig. 1. *Girasia hookeri*, Gray. Spirit-specimen, natural size. Khasi Hills. View of right side: *c*, cicatricial line marking the junction of the right and left shell-lobes.
1 *a*. Ditto: left side.
1 *b*. Ditto: dorsal aspect.
2, 2 *a*, 2 *b*. Ditto: shell of.

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* Plates LII.-LXII. published September 1887.

Fig. 3. *Austenia gigas*, Bs. Right side of animal from spirit specimen, natural size.
3 *a*. Ditto: view of left side.
3 *b*. Ditto: viewed from the back, the portion within the apex of the shell cut off, to show more clearly the shell-lobes on the posterior margin: *hd*, hermaphrodite duct, position of, passing back to the ovo-testes.
4, 4 *a*, 4 *b*. Ditto: shell natural size.

EXPLANATION OF PLATE LVI.

Fig. 1. *Girasia magnifica*, Nev. & G.-A., natural size. Momein, Yunnan. View of right side.
2. Ditto: viewed from above, showing the cicatricial junction of the right and left shell-lobes (*c*).
3. Ditto: view of left side.
4. Ditto: viewed from behind.
5, 5 *a*. Shell, natural size. Copied from J. A. S. B. 1881, plate v. Drawn and lithographed by Jules Schaumburg, Calcutta.

EXPLANATION OF PLATE LVII.

Fig. 1. *Africarion ater*, G.-A. Travancore and Tinevelley Hills, S. India. View of right side, × 2·4. Shell removed.
1 *a*. Ditto: view of dorsal side, × 2·4.
1 *b*. Ditto: view of left side, position internally of the muscle-attachment of the retractor penis (*m*), × 2·4.
1 *c*. Ditto: portion of sole of foot, × 2·4.
2, 2 *a*. Shell, from above and below, × 2·4.
2 *b*. Ditto: natural size.
3. *Africarion ater*, var. *aterrimus*, natural size.
3 *a*. Ditto: viewed from behind, × 2·4.
3 *b*. Ditto: sole of foot, anterior portion, × 2·4.
3 *c*. Ditto: jaw, × 12.
4, 4 *a*. Ditto: shell, × 4. Showing the membranaceous peristome (*p*).
5. Ditto: generative organs of var. *aterrimus*, × 2·4.
5 *a*. Ditto: male organ of *ater*, × 4. Showing the spermatophore in process of formation (*s*).
6. *Africarion ater*, var. *cinereus*, natural size.
7. Shell of *Africarion auriformis*, Blf., × 2·4. Sispara Ghat, Nilgiri Hills.
7 *a*. Ditto: natural size.

EXPLANATION OF PLATE LVIII.

Fig. 1, 1 *a*, 1 *b*. *Girasia* (*Dekhania*) *beddomei*, G.-A., natural size. Travancore Hills. Viewed from above and on the right and left sides. From spirit-specimen.
2, 2 *a*, 2 *b*. Shell of ditto, × 2·4.
3. Ditto, young, × 2·4.
4, 4 *a*. *Girasia beddomei*, var. *maculosa*, natural size. Viewed from above and right side.
5. Ditto, var. *nigra*, natural size. View of right side.
6, 6 *a*, 6 *b*. Ditto, var., natural size. Viewed from above and on right and left sides.

EXPLANATION OF PLATE LIX.

Fig. 1, 1 *a*, 1 *b*. *Girasia pankabariensis*, G.-A.; animal, × 1·5. Viewed from right side, above, and left side respectively.
2, 2 *a*. —— (*Ibycus*) *sikimensis*, G.-A.: animal, × 2·4. Viewed from right side and above.
2 *b*. Shell of ditto, × 2·4.
3, 3 *a*, 3 *b*. *Girasia* (*Ibycus*) *sikimensis*, var. *mainwaringi*, Nevill, MS.: animal, × 4.
4. —— (——) *cacharica*, G.-A.: animal, × 2·4.
4 *a*, 4 *b*. Shell of ditto, × 2·4.
5, 5 *a*. *Austenia? venusta*, Theobald, × 2·4.
6, 6 *a*, 6 *b*. *Girasia peguensis*, Theobald: animal, natural size. Viewed from right side, above, and left side.
6 *c*. Shell of ditto, × 2·4.
6 *d*. Ditto, natural size.

EXPLANATION OF PLATE LX.

Fig. 1, 1*a*.	*Austenia gigas*, Bs.	Teria Ghat, Khasi Hills.
2.	*Girasia crocea*, G.-A.	Teria Ghat, Khasi Hills.
3.	—— *hookeri*, var. *brunnea*.	Shillong, Khasi Hills.
4.	Ditto, ditto.	Shillong, Khasi Hills.
5.	Ditto, ditto.	Shillong, Khasi Hills.
6, 6 *a*.	*Girasia radha*, G.-A.	Durrang District, Assam.
7.	—— *butleri*, G.-A.	Naga Hills.
8.	—— *cinerea*, G.-A.	Dafla Hills.

EXPLANATION OF PLATE LXI.

Fig. 1. *Girasia dalhousiæ*, G.-A.: view of right side, × 1·5.
1 *a*. Ditto: viewed from above.
2. *Girasia burtii*, G.-A.: shell, natural size.
3. —— *nagaensis*, G.-A.: view of right side of mantle.
3 *a*. Ditto: view of mantle seen from above; *p*, posterior end.
3 *b*. Ditto: extremity of foot, showing mucous gland.
3 *c*. Ditto: shell, natural size.
4. *Girasia rubra*, G.-A.: view of left side, from life.
4 *a*. Ditto: the right side of mantle and head, from life.
4 *b*. Ditto: mantle viewed from above; *p*, posterior end.
4 *c*. Ditto: extremity of foot, from life.
4 *d*. Ditto: shell, enlarged and natural size.
5. *Oxytes* (*Bensonia*) *labiata*, Pfr. Generative organs, × 2·4 (lettering as in former Plates): *sp*, the spermatheca is seen filled with a bundle of spermatophores.
5 *a*. Ditto: central teeth of odontophore; 5 *a'*, 19th to 23rd median teeth; 5 *a''*, 36th to 40th lateral; 5 *a'''*, the outermost laterals, × 185.
5 *e*. Ditto: portion of spermatophore, × 4; *b*, basal end.
5 *f*. Ditto, ditto, anterior end, × 12.
5 *f'*. Ditto, ditto, middle portion.
5 *f''*. Ditto, ditto, basal end, × 12.
5 *g*. Ditto, the anterior portion of capsular end.

EXPLANATION OF PLATE LXII.

Fig. 1. *Girasia hookeri*, Gray: central, no. 34, 35, 36, and outermost lateral teeth of odontophore, × 185; 1 *a*, jaw, enlarged.

2. —— *magnifica*, Nevill: central and lateral teeth, × 185.

3. —— *radha*, G.-A.; central, median, and lateral teeth, × 185; 3 *a*, jaw, × 12; 3 *b*, generative organs, enlarged. Lettering as in former Plates.

4. —— *dalhousiæ*, G.-A.: central, nos. 12–16, and outer lateral teeth, × 185; 4 *a*, jaw, × 12.

5. —— (*Ibycus*) *cacharica*, G.-A.: median teeth, 12–15, and the outermost laterals; 5 *a*, jaw, × 12; 5 *b*, the basal end of the amatorial organ, × 12; 5 *c*, part of the generative organs.

6. —— *crocea*, G.-A.: central, median, and some of the lateral teeth, × 185.

7. *Dekhania beddomei*, G.-A.: central, lateral, and outermost laterals, × 185; 7 *a*, jaw, × 4.

8. *Austenia gigas*, Benson: central, median, and lateral teeth, × 185; 8 *a*, jaw, × 4.